Rock Products

With which is Incorporated CEMENT and ENGINEERING NEWS

Founded 1896

Volume XXXV Chicago, May 7, 1932 Number 9

Making Cement in the Far East

Cebu Portland Cement Co., Tina-an, Naga, Cebu, P. I., Has Rebuilt to a Modern Mill

By H. M. Power

General Superintendent; formerly Superintendent of Redwood City and Suisun Plants of the Pacific Portland Cement Co.

THE Cebu Portland Cement Co. began operations in October, 1923. It is a government owned corporation, being a subsidiary of the National Development Co., which is a government entity designated to exploit the natural resources of the Philippine Islands.

The plant is located near the sea shore in the barrio of Tina-an, Naga; a distance of 22 kilometers from the city of Cebu. The Philippine railway passes in front of the plant, and track sidings connect the plant for handling shipments of cement.

The capacity of the plant was built to produce 1000 bbl. of cement daily, but due to changes made in some of the machinery from the original design, it is now producing 1400 bbl. of cement daily. The layout shows very careful planning, so the materials from raw ingredients to finished product follow a logical sequence throughout the plant. The buildings are of structural steel frame work covered with corrugated iron, except the power house, which is built of concrete.

Quarry and Rock Haulage

Three different classes of raw material are available for the manufacture of cement, although only two are being used. The principal raw material is a high lime cement rock found beside the plant, the other raw material being a low lime cement rock also found at the plant site. These both may be classed as clayey, coralline limestones. One feature of this quarry is that all materials required for making cement, except gypsum, can be obtained from the same quarry floor. The analysis of these are as follows:

	High lime	Low lime
SiO_2	11.00%	19.42%
Al_2O_3	4.20%	6.29%
Fe_2O_3	1.52%	2.25%
CaO	46.10%	37.81%
MgO	0.80%	0.74%
Loss on ignition	36.31%	31.04%
$CaCO_3$ titer	81.20%	66.60%

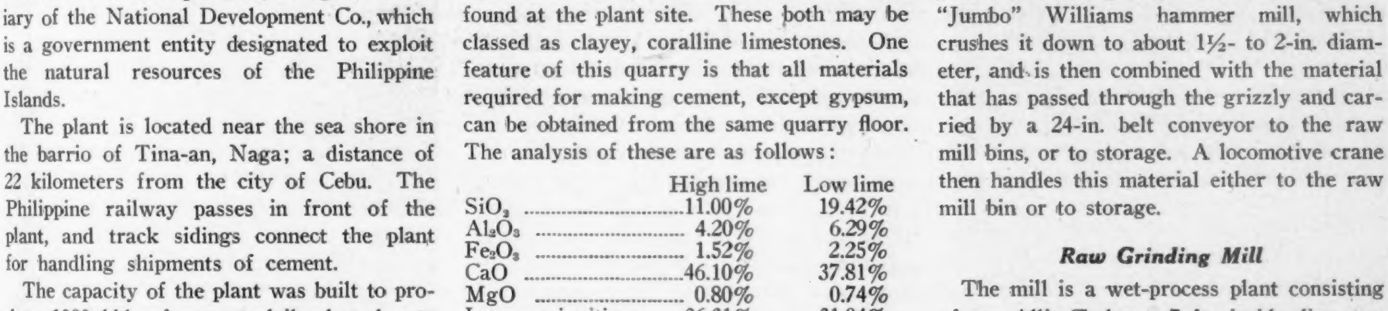
The quarry railroad equipment consists of two 20-ton Davenport saddle-tank locomotives, 42-in. gage, and twenty-five 4-ton quarry side-dump cars. The excavation equipment consists of one Marion steam-shovel, Model 61, and one Marion steam-shovel, Model 450; this latter shovel is used to handle the low limerock. The primary crusher is a 24-in. by 60-in. Allis-Chalmers Fairmount type, driven by a 100-hp. Allis-Chalmers a.c. 440-v. motor; this breaks the rock down to a size of about 4 in.; the discharged rock passes over an Allis-Chalmers roller grizzly; that which goes through the grizzly is conveyed to the rock storage and that which passes over the grizzly is fed into a No. 5 "Jumbo" Williams hammer mill, which crushes it down to about 1½- to 2-in. diameter, and is then combined with the material that has passed through the grizzly and carried by a 24-in. belt conveyor to the raw mill bins, or to storage. A locomotive crane then handles this material either to the raw mill bin or to storage.

Raw Grinding Mill

The mill is a wet-process plant consisting of one Allis-Chalmers 7 ft., inside diameter, by 26 ft. compeb mill, lined with heavy steel plates and having a 65,000 lb. load of steel balls. The rock from the feed storage bin is fed into the preliminary end of the mill by a rocker feeder. With the rock there is fed 35% by weight of water. This mill is driven by a 500-hp. Allis-Chalmers synchronous motor, 2200-v. a.c., connected with a 60-in. Cutler-Hammer magnetic clutch.

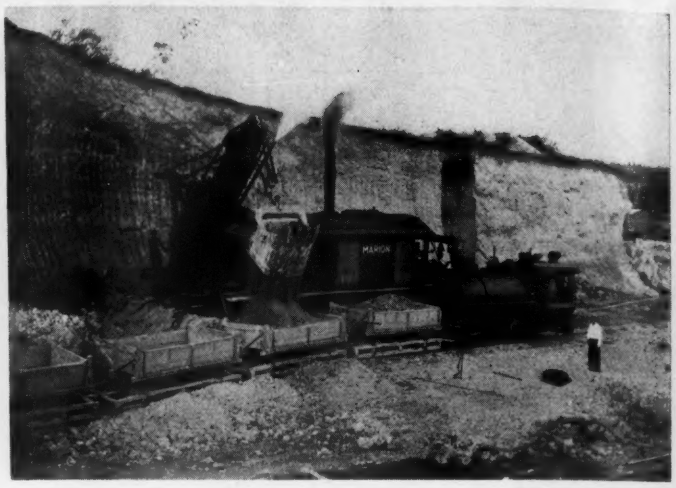
Slurry Storage

The slurry from the mill runs to a 3-in. Wilfley slurry pump and from there is pumped to four steel cylindrical storage



Panorama of the plant of the Cebu Portland Cement Co., Tina-an, Naga, Philippine Islands

Low lime quarry; 1 1/4-yd. shovel loading 4-cu. yd. cars

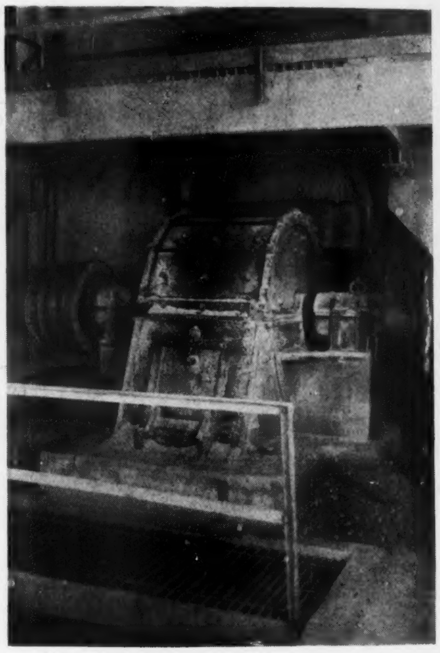


High lime quarry; 2 1/2-yd. shovel loading 4-cu. yd. cars

tanks. Up to this point of operation the percentage of lime, clay and silica in the slurry has been proportioned in accordance with the best judgment of those who have received and stored the rock and the chemist who directed the withdrawal of the rock from the storage pile. These tanks are equipped with Minogue agitators, which assures positive and complete agitation of all the slurry and eliminates any building up of slurry on the bottom of the tanks. The tanks are divided into two classes: Mill tanks for storing the slurry as it comes from the mill, and kiln-feed storage tanks.

Primary, slugger-roll crusher

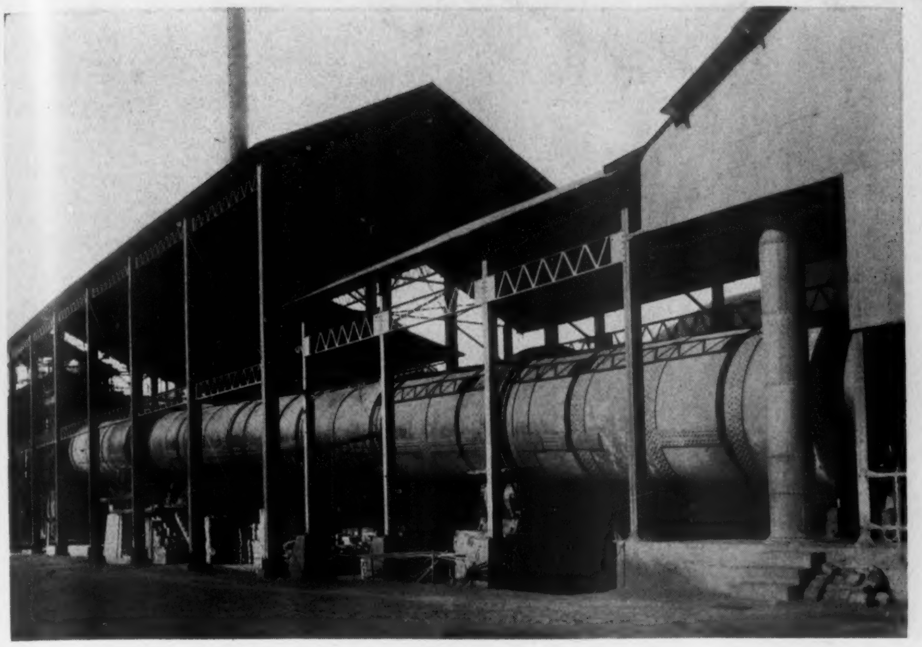
A chemical analysis is made of the slurry in the mill tanks after it has been thoroughly agitated. Some of these run slightly too high in lime and some slightly too low. When the analysis has been made, the different grades of material are run by gravity and proportioned into two kiln-feed tanks. These tanks are also equipped with Minogue agitators. The slurry is pumped from these tanks by a 3-in. Wilfley slurry pump to a Ferris wheel type feeder and fed into the rotary kiln. This kiln is of Allis-Chalmers make and is 11 ft. by 10 ft., inside diameter, and 175 ft. in length; it is lined with a 9-in. lining of refractory brick in the burning zone and 6-in. lining of brick on the upper end. The kiln has two sets of carrying rolls and tires and is driven by a 60-hp. 440-v. a.c. Allis-Chalmers motor through reduction gears. The kiln is fired with coal. The temperature of the kiln at the firing end is



Secondary, hammer-mill crusher

Locomotive crane handling raw material into mill bin

Slurry bins and mechanical slurry agitators



Rotary kiln 11 ft. x 10 ft. x 175 ft.

Pulverized coal used for fuel

about 2600 deg. F. and at the feed end 1300 deg. F.

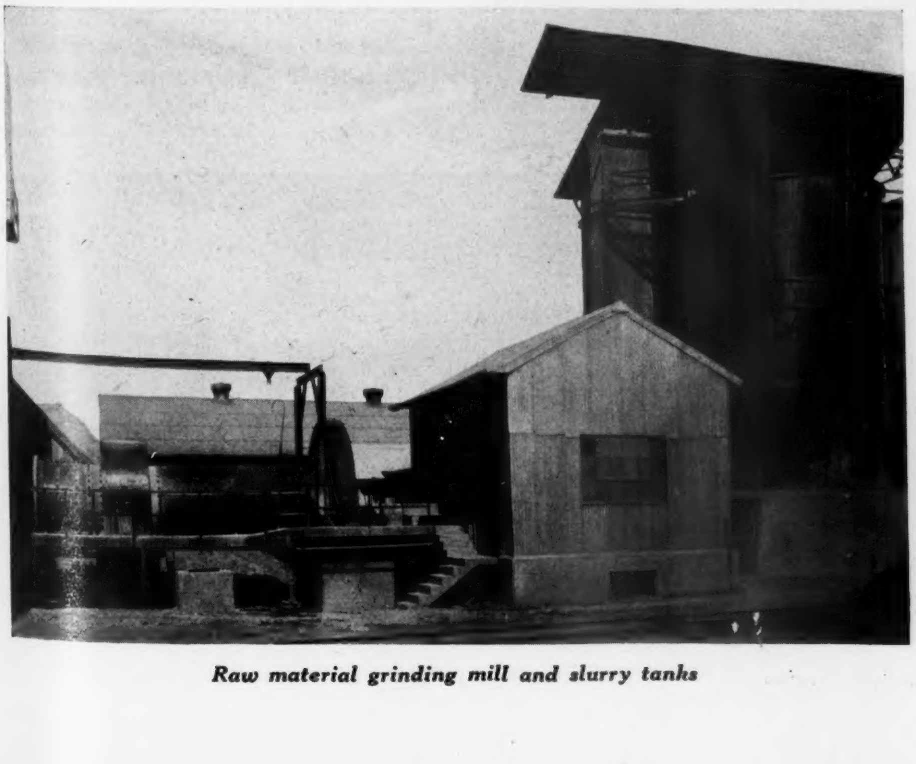
Coal Mill Equipment

Coal is unloaded from the railroad cars by an overhead electric crane. An "Ebro" type coal dryer 5 ft. by 50 ft. is used for drying the excess moisture. The grinding of coal is done by a 5-ft. by 22-ft. Allis-Chalmers dry grinding compeb mill driven by 175-hp. Allis-Chalmers synchronous motor 2200-v. a.c., connected with a 40-in. Cutler-Hammer magnetic clutch. The coal is ground to a fineness of 95% minus 100-mesh. From the discharge of the mill it is elevated into a 30-ton bin; from here it is conveyed to the kiln coal bin and then fed into the kiln. A No. 60 type "E" Sirocco fan is used to blow the coal.

Storage of Clinker and Clinker Grinding

The clinker is discharged from the end of the kiln into a 16-in. by 8-in. single-chain, inclined elevator, where it is delivered into the clinker storage. This storage is 75 ft. wide by 500 ft. long and has a capacity of 75,000 bbl. It is equipped with a 5-ton overhead Milwaukee crane, electrically operated, which travels the entire length of the bin. The crane operates a 1½-cu. yd. grab bucket which takes the clinker from the discharge point of the bucket elevator and distributes it throughout the storage bin. The gypsum which comes to the plant by train is unloaded with the grab bucket and put into storage at one end of the bin.

The clinker and necessary gypsum is conveyed from the storage by the grab bucket of the electric traveling crane to the storage bin over the finish mill, where it is fed into a 7-ft. by 26-ft. Allis-Chalmers dry compeb mill driven by a 500-hp. Allis-Chalmers synchronous motor, 2200-v. a.c., connected with a 60-in. Cutler-Hammer magnetic clutch. The cement discharge from the mill is taken by bucket elevator and deposited into 12-in. screw conveyors, where it is then deposited into three steel storage silos adjacent to the packing house. If for any reason the elevator is not in operation, there is installed a 6-in. Fuller-Kinyon cement pump to handle the cement from the mill discharge direct to the silos.



Raw material grinding mill and slurry tanks

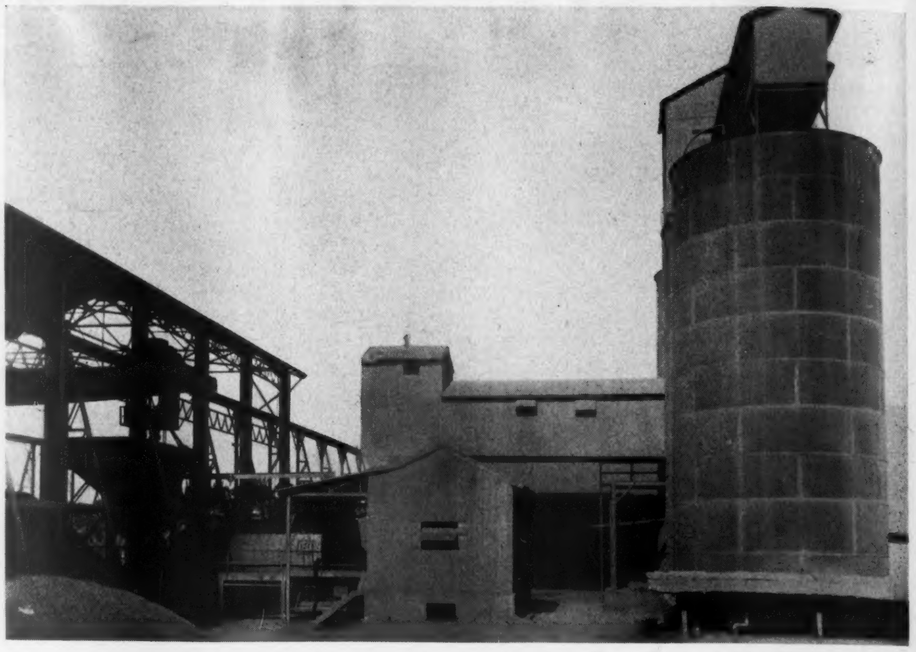
Cement Storage Shipping and Packing in Bags and Barrels

The storage capacity of the steel silos is 16,500 bbl. There is a tunnel under the silos in which two 12-in. conveyors operate, handling the cement from the silos into a bucket elevator, where it is elevated to the top of the packing house. It is then taken through a rotary screen which removes any foreign matter and renders it ready for packing and shipping. A 3-tube Bates packing machine is used for jute and paper sacks; four barrel shakers are used for handling cement shipped in metal barrels.

The barrel head department consists of two Fay and Egan No. 2 planers, two 16-in. table cut-off saws, two tongue and groove machines, and two 36-in. tilting table band saws. Lumber is purchased from mills here in the islands for the making of barrel heads. The barrel assembly department consists of one 36-in. folder, one 36-in. groover and one punching machine; steel sheets are first rolled and then crimped and holes punched ready for riveting. All machines are power driven.

Waste Heat Power Plant

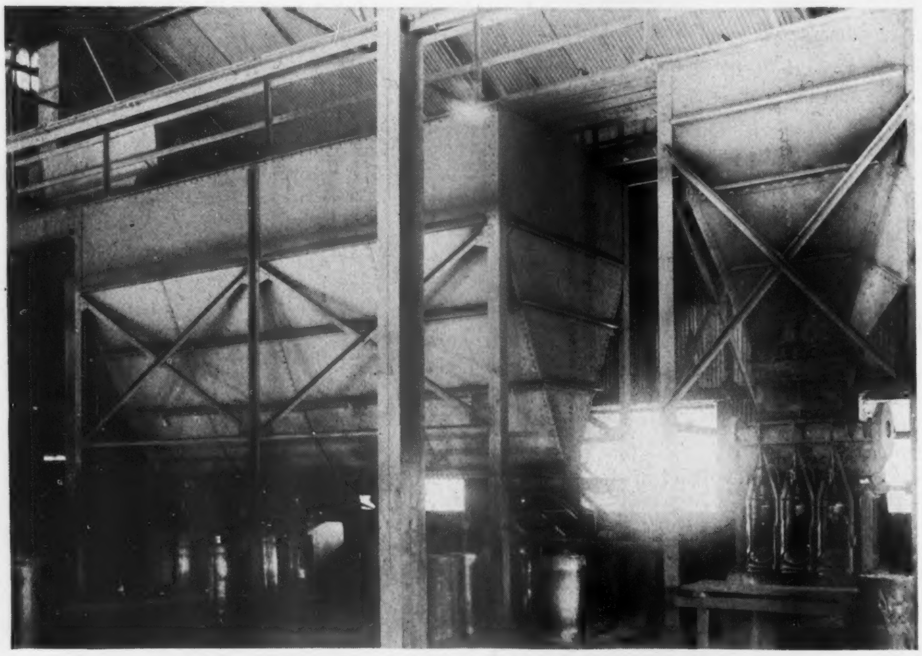
The power plant, utilizing waste heat from the kiln, is one of the most complete and modern installations of the kind that has been made. The electrical and auxiliary equipment was furnished by Allis-Chalmers Manufacturing Co. The waste-heat boiler is of the Edge Moor make, of the three-pass type and of 800 hp.; steam flows from this boiler to an Allis-Chalmers turbo generator 1250-kw. 2300-v. a.c., and then to a condenser. Salt water is used in the condenser, taken from the bay in front of the plant. To provide steam for starting and also when the kiln is down, there is an auxiliary boiler of the Edge Moor make, 300-hp., which is fired with coal. An Allis-Chalmers turbo generator 125-kw. 2300-v. a.c. is in reserve for lighting and fire purposes should the main turbo generator be stopped at any time. Griscom-Russel evaporators are used for distilling all water used in the boilers.



Overhead traveling crane feeding clinker to compeb mill bin

Machine Shop and Storeroom

The company maintains a machine and repair shop fully equipped with modern electrically-driven machine shop tools. Here all repairs are made. In a building next to the machine shop is located the storeroom. This storeroom is exceptionally well arranged and well kept. In addition to the inside storage there is maintained an outdoor storage for rough repair parts. Duplicate parts are kept of all equipment that is at all likely to need replacing. No piece of apparatus can be taken out without a properly signed order on the storekeeper.



Packing department, loading metal barrels, as well as cloth and paper sacks

Office and Laboratory Department

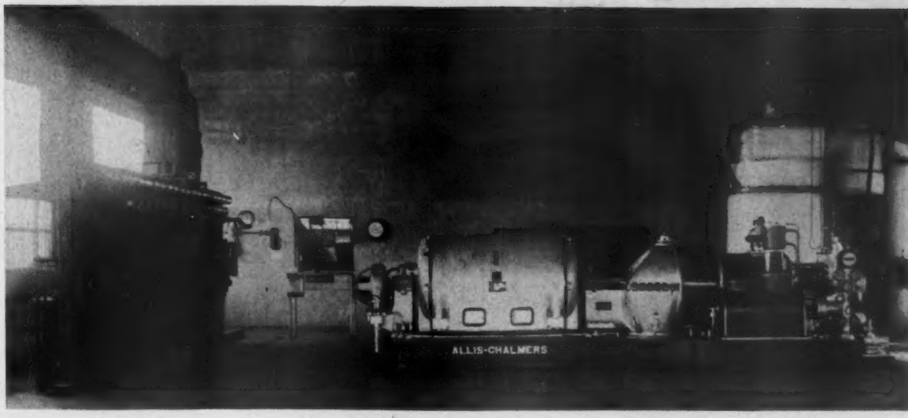
The office building is of steel structure and corrugated iron. Books of account and all records are kept here. The chemical laboratory occupies one side of the office building and is thoroughly well equipped. In the basement beneath the laboratory is located the physical and testing department with facilities for all standard tests. The laboratory department is under the chief chemist and a staff of assistants. This department

Department for making heads for metal barrels

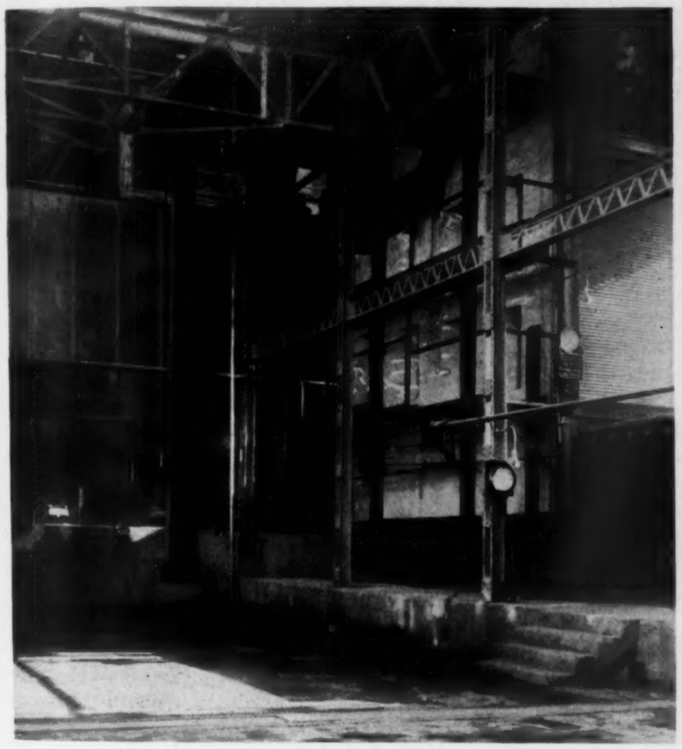
Machine shop, equipped with electrically driven tools

operates in three 8-hour shifts, as there must be one or more chemists on duty at all times when the mill is operating. The most important work of the laboratory is the proportioning and proper blending of the raw materials and this goes hand in hand with the operation of the plant; 119 samples of different materials are tested every day.

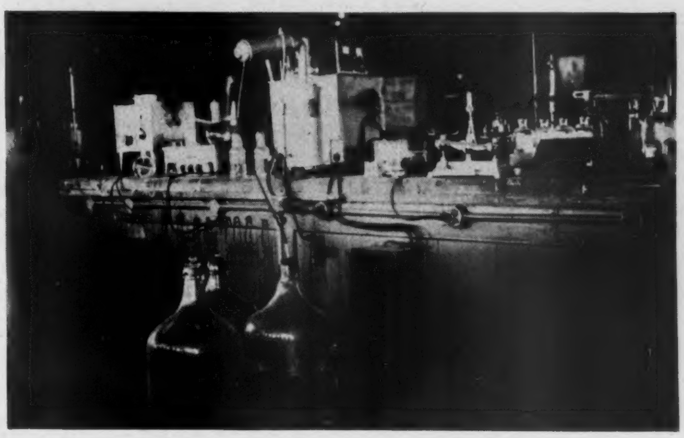
Complete analysis of the raw materials is made daily and control tests every hour. Orders are periodically given to the raw grinding department specifying the desired mixtures. The product from the raw mill is sampled every hour and tested for carbonates, fineness and moisture content. Further accuracy is obtained in two special tanks



Steam turbo-generator, 1250 kw., 2300-v., and switchboard



Waste-heat boiler plant, 800-hp., said to be one of the most modern and efficient in the portland cement industry anywhere

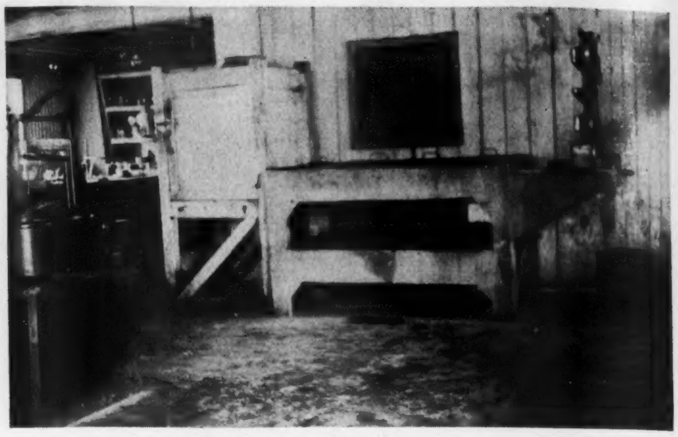


Laboratory; still, electric oven, etc.

Physical laboratory, pulverizers, etc.

ABOVE—Section of chemical laboratory, showing work table, reagent shelf and hood. TO RIGHT—Another section of chemical laboratory showinb muffle furnace, hot plates, etc.

Section of chemical laboratory showing analytical balances and calorimeter



Section of physical laboratory showing sieving machine, moist closet, etc.

called correction tanks in which the final blending is made preparatory to sending the material to the rotary kiln for burning to incipient fusion. Hourly samples are taken from the kiln and the burnt material is tested for chemical composition and physical properties.

Finished Product Sampled Every 20 Minutes

The finished product is sampled every 30 minutes as it leaves the finish mill and tests are made for chemical composition, fineness, setting time, mortar strength, and soundness.

All of these tests are sufficient to insure a cement of extremely high quality, but still further tests are made as the cement is placed in the containers. This system of rigid chemical control makes it possible for the company to guarantee each and every barrel of cement sold.

The quality of "APO" portland cement is very high, as shown by the following tests. The uniformity (which is just as important as high quality) is also remarkable. The following results are averages for a year's operation:

TEST RESULTS

Fineness—200 mesh = 86.6%
Soundness* = Perfect

Tensile strength 1:3 standard mortar:

1 day	231 lb. per sq. in.
3 days	293 lb. per sq. in.
7 days	361 lb. per sq. in.
28 days	462 lb. per sq. in.

Personnel

The officers of the company are Alberto Barretto, president and general manager; Paciano Dizon, vice-president; Claude Russell, vice-president; Jesus J. Santos, secretary-treasurer and purchasing agent; F. A. Reyes, sales manager. The supervision of the plant and its operation is under the author as general superintendent, while the quality of the product rests with E. Taylor, chief chemist. The general offices of the company are at China Bank Bldg., Manila, P. I.

*Withstand five hours in steam without a single crack.

Effect of Aggregate Type on Elasticity of Concrete

A VARIATION in the value of E as great as 100%, due to differences in the type of aggregate used, was found in studies of concrete recently made at Kansas State College. They are reported in Bulletin No. 29 of the Engineering Experiment Station by P. M. Noble, instructor in applied mechanics, and the tests were made under the direction of Professor Scholer.

The aggregates tested were sand-gravel, a material much used in Kansas and Nebraska, where good deposits of coarse aggregate are far apart, a local soft limestone, a hard limestone, Joplin "flint," which is really chert, and is the refuse from the mills that treat zinc-lead ore, and a hard flinty gravel from deposits near Cowley, Kan. The sand-gravel is really a coarse sand but it is somewhat carefully graded for use. All grains passed ¾-in. and about 4 to 8% was retained on ⅜-in. The fineness modulus varied from 3.5 to 4.4. It was used in mixes from 1:3 to 1:5, the w/c ratio varying from 0.6 to 0.9. The other aggregates were graded to 50% on ¾-in., 80% on ⅜-in. and 100% on No. 4. A granitic river sand (F.M. 2.75) was the fine aggregate and the mix was 1:1¾:3½ in all cases.

Much of the report is given over to details of testing, for one of the features wanted was to bring out the effect of speed of loading. It was found that this had little effect on either the value of E or Poisson's ratio.

The type of aggregate used had a great effect, and to show this the values of E for the different aggregates have been averaged from the results given. These are for the 28-day strengths only, as the relative positions did not change with greater ages.

Aggregate	Modulus of elasticity E in. lb. per sq. in.
Sand-gravel (in 1:4 mix only)	3,744,000
Local limestone	3,406,000
Moline limestone	4,469,000
Lincoln sandstone	4,753,000
Joplin flint	5,794,000
Silverdale gravel	5,679,000

These results would seem to justify the conclusion of the report that the variation due to type of aggregate is so much that it should by all means enter into the design of reinforced concrete structures.

But there were other factors besides the type of aggregate that affected the modulus of elasticity. The value of E increased quite markedly up to 56-day age. After this the increase was less rapid, and there are some indications of a slight decrease with greater ages. Poisson's ratio appears to increase very slightly with age.

With the sand-gravel concretes E tended to increase with the increase of fineness modulus, although no relation was found between fineness modulus and Poisson's ratio. The maximum value of E was with 1:3½ and 1:4 mixes. The table shows these all had w/c ratios of 0.7, slumps from 0.25 in. to 1.5 in. and compressive strengths from 3052 to 4080 lb., with a cement factor of 1.45 to 1.56 bbl. Richer and leaner mixes had lower values, but the value of the richer mixes increased with age. With all aggregates the maximum value of E was with a w/c ratio of 0.7.

A feature of general interest was the behavior of the concretes that were dried at 100 deg. C. in an oven. The pronounced decrease in the modulus of elasticity showed that these concretes had been permanently damaged.

Safety Practices in Gold Dredging

AT ONE TIME the dredges of California produced almost as much as the lode mines, states a bulletin, "Safety Practices in California Gold Dredging," in explaining the importance of the subject as measured by the activity in the industry. The bulletin has recently been issued by the Bureau of Mines and contains extensive figures on the accident record of various operations, together with safety rules and recommendations for safe practice as established from experience. These undoubtedly would prove helpful to sand and gravel dredge operators.

Economics of the Nonmetallic Mineral Industries*

Part XV—Products and Research

By Raymond B. Ladoo

Recently Manager of the Industrial Commodities Department, United States Gypsum Co.

FEW COMPANIES which have been in business many years, even fairly small companies, make but one product. They soon find that they have byproducts to condition and market, or that the needs of their sales departments call for additional products to distribute in order to cut down sales cost. Or they find that their overhead cost is too great to spread over the sale of a single product. These and other causes soon force a company into the handling of a line of products instead of a single one. The choice of the additional commodities may be deliberate or, one by one, new products may be added more or less by accident or by chance. Sooner or later, however, a company is faced with the problem of deliberate expansion. The continued prosperity and stability of an energetic and growing company depend in some degree upon the wise determination of its directional growth.

Should a company confine itself to products made from one primary raw material? Or should sales and distribution conditions govern, and should only products be made which go into one type of industry? For example let us take a successful growing portland cement company with two or three plants. Should it stick to cement and grow by making different types of cement and cement products and by buying or building other cement plants? Or should it utilize its limestone for other purposes and build lime plants? Or should it consider chiefly its marketing field, that is, the building materials field, and go into the production and sale of a full line of building materials, such as brick, tile, sewer pipe, wall plasters, roofing, paints, etc.? Or, after a certain amount of growth in the cement field, should it step out into an unrelated field, such as refractories or heavy chemicals?

The easiest way to grow, of course, is along the familiar line, that is, by adding more units like the first one. Up to a certain point, in most of the nonmetallic mineral industries this is not only the easiest but the wisest course to pursue. If a company starts out as a cement company, both its production and sales organizations know cement best, and can more efficiently handle the production and sale of the output of a new cement plant than they could a lime or a gypsum plant. But after a company reaches a certain point in this type of growth, further expansion may be unwise or it may be blocked by large competitive organizations or by the Federal Trade Commission. The company must then either be content with what it has or it must deliberately plan other lines of growth.

Editors' Note

SOONER OR LATER every progressive concern is faced with the problem of expanding its operations. Should it add more production facilities in the same field or look to greater diversification of its line?

Closely related to this subject is the place of research and product development. What is true research and what are its functions and dividends? What is the distinction between true research and other laboratory and experimental work?

The author answers these pertinent questions and discusses ways and means by which research and product development may be accomplished by any progressive producer.—The Editors.

From one standpoint the soundest type of growth is into closely related fields, where production or sales problems, particularly the latter, resemble those with which the company is familiar. Thus, if a company is familiar with the production and sale of cement, lime, gypsum products and other building materials naturally suggest themselves. Undoubtedly these allied fields are the easiest and safest to enter, but this type of growth has a serious disadvantage. All the company's interests are dependent upon the prosperity of the construction industries. A serious decline in building affects all or nearly all of the company's products.

How to Expand?

Economically the safest type of expansion, although the most difficult, is into a field not too closely related in sales distribution to that in which a company is well established. Of course, it would be unwise and absurd for a cement company to attempt to enter the textile field. The two industries are too totally unlike to be successfully handled by one management. But there are fields, such as refractories or heavy chemicals, or even fertilizers, which would be attractive. Managements which are able, sound and aggressive can quickly acquire the essential details of a new business. Management problems are pretty much the same in all industries. Men trained and experienced in the new line can be employed and the special problems can be studied and solved. Very often the injection of entirely new blood into an old established industry brings new ideas and greatly increased efficiency. Men too long in one industry often are so close to their problems they do not have the proper perspective; they are too much bound by precedent and habit, and too unfamiliar with how other industries have progressed and solved similar problems.

A mediocre management that is not alert and progressive and open-minded, which has made only a fair success in its own line, probably should stay on familiar ground. Very likely it would anyway; expansion into other fields would not be apt to have any appeal.

In the great majority of cases the familiar field is chosen, but the alternative plan offers great possibilities if a company wishes to insure steady earnings. Diversification of sales channels, unless a fairly extensive line is carried in each, may and probably will tend to increase distribution costs at the start, but eventually the advantages of better balanced investment of capital will overcome this or more than offset it.

Research and Development

The time has come when there is a need for accurate technical data about mineral products, both those used for industrial purposes and for building materials. In industrial plants old-time rule-of-thumb methods are rapidly being replaced by carefully controlled technical processes. More and more are architects, engineers, contractors and builders buying on specification and insisting on accurate physical and chemical data about the raw materials they buy and use. The old type of purchasing agent who bought on friendship and price alone is rapidly being replaced by the man who buys on performance. Even the ultimate consumer is being educated by advertising to buy quality goods on the basis of ultimate value rather than

first cost. This means that men selling many types of mineral products today must be provided with real facts about their materials; high pressure sales arguments no longer go. Almost every industry in the nonmetallic mineral field is affected to some degree by this changed attitude toward quality. Even the producers of crushed stone and sand and gravel have constantly more restrictive specifications to meet.

This raising of product standards has meant more careful and better production methods and laboratory control of quality, and the development of better physical and chemical testing methods. At the present time many companies and whole industries have been content to stop here. They have merely standardized and made more uniform the same products they have always made, produced by time-honored methods. They have failed to grasp the fact that there is much to be done and much to be gained from research into the basic physical and chemical properties of their raw materials, the finished products which they make, and their production methods and equipment.

In recent years we have all heard much about research and its value to industry. Perhaps, in a way, research has been "oversold." Surely the word "research" has been much abused and overworked. Many producers have been so charmed with the word and so impressed with the magic that research may perform for them, that they have hired a chemist and started what they thought was research. They have set him at more or less routine testing and perhaps product development work, and expected paying results in six months. If worthwhile results are obtained under any such conditions, they are purely accidental.

Laboratory Work Essential

Laboratory work may be of many different kinds, but very little of it is true research. Routine product testing and analysis is necessary and valuable. So are the investigation of complaints and the testing of competitive products. New product development is often an essential and highly profitable branch of laboratory work. But none of these is true research in the strict sense of the word. True research involves the basic and systematic study of fundamental physical and chemical properties of materials. It means reaching out into the unknown for basic facts, for which the practical application is not always or often clearly in view. Pure research resembles advertising in several ways. It is founded on faith. You either believe in it or you don't. Immediate paying results cannot be expected. Worthwhile results can only be assured by persistent, well-directed, intelligent effort over a long period of time. If properly done, it is, ultimately, exceedingly well worth while and is a paying investment.

The economic value of pure research has been so thoroughly demonstrated that it is hardly worth while to argue the point. Whole industries have been built up upon the results of pure research. The radio, the telephone, the phonograph and rayon are a few outstanding examples, and there are hundreds if not thousands of others. But pure research usually costs a lot of money, it is admittedly slow in paying dividends, and, what is perhaps the most important, it is difficult to find men capable of doing research of a high order. A good research man, in addition to a sound technical and scientific education and experience, must have imagination, persistence, resourcefulness, determination, and a practical sense of values. All this means that true research cannot be carried on by small, financially weak companies. It is peculiarly the function of public institutions, trade associations, large commercial laboratories, and large, well-financed companies.

Distinction Between Research and Technical Development

Probably the distinction between true research and technical development is not always clear. As noted before, what passes for research in many companies is really nothing but product development. For example, the sales department of a company may decide it can sell to advantage a certain type of paint for a special use. There are other paints for this purpose on the market, but none of outstanding merit. So they ask the research department to develop a paint for them. The laboratory proceeds in a systematic fashion to test out all the competitive products, determine their compositions and their advantages and disadvantages. Then from cumulative experience with paint materials they begin to make up a trial series of new paints. Eventually they hit upon a product which, by all the usual tests, seems to answer the problem, and it is turned over to the production and sales department as the desired new product. This sort of work is often, if not usually, called research, but of course it is not. It involves no addition to the sum of human knowledge.

Perhaps one of the best ways to distinguish true research from product development is to consider the purpose of the work and the method of handling the problem. In product development the desired end point is known in advance. We are merely putting together known materials to make a desired product. In true research we seek unknown fundamental information about materials or processes. We apply physical and chemical processes to minerals or other substances in ways which have not been previously tried, without any knowledge in advance of what the results may be or how such results might be used commercially. Many of our most valuable chemical products and processes have been discovered either by accident or by pure research.

Of course a research worker does not follow entirely "hit or miss" methods. He does not work entirely in the dark. His previous training and experience gives him some idea of what he may expect and enables him to go more quickly and directly toward his goal. He gets an idea from some known product or process and, reasoning from analogy, he wonders what would happen if he should put this and that together and do that and this to the combination. Perhaps nothing happens, or perhaps what he believed might happen does happen, or perhaps something else entirely unlooked for takes place. These unexpected results are often extremely important. Such byproducts of research may be more valuable than the main ends sought.

Things a Research Department Should Do

A good research man or research department will have sufficient business acumen to know what "leads" are worth following, how far to follow them, and how to apply practically the new knowledge. There is no denying the fact that much pure research apparently ends nowhere. Considerable judgment must be exercised, an unprofitable line of investigation must be recognized and discontinued before too much time is wasted. But if research is done intelligently, persistently, patiently and consistently over a considerable period of time it practically always results in success—commercial success far surpassing its cost.

All of what has been said about true research should not be interpreted as belittling the other types of technical investigation and chemical work. There are many other technical functions which are very important—indeed, essential. Some of these functions are:

I. *Technical Investigation and Fact Finding*
- *A.* Surveys of product and process development in other companies and other countries.
- *B.* Surveys of present or possible markets (market research).
- *C.* Collection of accurate data on machine performance; for example, competitive testing of rock drills, grinding machines, etc.

II. *Laboratory Testing and Control*
- *A.* Routine testing and analysis of raw materials, intermediates and finished products for product and process control purposes.
- *B.* Testing and analysis of supplies; for example, testing of coal, fuel oil, lubricating oils.
- *C.* Testing and analysis of competitive products.

III. *New Product and Process Development*
- *A.* Improvement of old products and processes.
- *B.* Development of new products and processes.

IV. *Study of Consumers Products and Processes*

The purposes here are to adapt producer's materials to the specific needs of the consumers, to solve consumer's problems of utiliza-

tion, to furnish information for intelligently handling complaints on quality, and to obtain data so that the proper use of a material may be demonstrated in going after new business.

All of these functions are highly important and most companies today provide for all of them or for such of them as their size and financial resources permit. The unfortunate thing is, however, that too many companies stop here. They believe that they are doing research and often point with pride to the large amount of research they are doing.

Group Research

As has been noted before, true research may be beyond the financial scope of individual companies of small or moderate size. But this does not preclude the possibility of small companies profiting by research. Group research is often the answer to the problem in such cases. The commonest forms of group research are those undertaken (1) by trade and technical associations; (2) by governmental bodies such as the U. S. Bureau of Standards and the Bureau of Mines; (3) by colleges, universities and technical schools; (4) by wholly or partly endowed institutions such as Mellon Institute and Carnegie Institute. There are now sufficient well established public or semi-public agencies, well equipped and staffed by able men, so that almost any group of companies can have done for them research work of a high order at a nominal cost per company.

Research by individual companies, of course, has certain advantages over cooperative or group research. Discoveries made in a company laboratory are the property of that company. They can be protected by patent or kept secret for a certain length of time, so that commercial exploitation results in profits to the one company alone. This may be a selfish attitude, but it certainly pays dividends, and the general public eventually benefits.

An extremely valuable byproduct or primary product of research and other technical work is the establishment of accurate standards for products and processes and of standard testing methods. Another such function is or should be the publication of technical data on products and methods of use. Too often the only available printed literature a company distributes consists of more or less clever advertising of brands and policies, with nothing about what the products really are and what they will do. They tell how good the X. Y. Z. Co. is and what wonderful service they give and that their brand of banana oil is the best on the market. But of useful technical data needed by the engineer, the chemist, the ceramist or the plant manager, there is often little or nothing. Some companies, however, do furnish excellent, accurate, detailed technical data on their products. This practice should be widely extended.

The technical and research men of a company not only should be permitted but should be urged to write for publication in technical and trade papers. If a man wants to know a subject well, the best possible training is to try to write about it. To write a clear, concise, accurate story about a product or process, one must know his subject thoroughly. Most of us find that when we start to write about something we really know less about it than we thought we did. In writing we learn. The publication of technical articles gives the writer a better grasp of his subject, it increases his professional prestige as well as that of his company, and it is excellent advertising for a company's products and policies.

(To be continued)

Effect of Size of Batch and Length of Mixing Time on Paving Concrete

THE January issue of *Public Roads* is largely given to discussing studies made by the U. S. Bureau of Public Roads of concrete paving work in Wisconsin and Arkansas. The purpose of these studies was to find how large a batch could be handled in the standard 27 E paver and how much the standard mixing time could be cut.

Beam molds were placed in the path of the paver and filled as the concrete was placed on the grade. Cylinders were made from the same concrete and 25-lb. samples were taken for washing. By washing the fresh concrete according to a system that provided checks against errors, the percentages of cement, sand and gravel in each sample were determined. A method of measuring uniformity was worked out and a variated factor was ascribed to evaluate uniformity.

Mixes were by weight and were based on a workability factor the b/b_0 of Talbot and Richart. This is the relation of the absolute volume (b) of the coarse aggregate in a cubic foot of the concrete to the absolute volume of a cubic foot of the coarse aggregate (b_0). The percentage of excess mortar is therefore $1\text{-}b/b_0$. Hence b/b_0 is an index of workability for any given set of job conditions. A chart, which is given in the report, furnishes a graphic method of finding the required weights of cement, sand and coarse aggregate when the b/b_0 ratio has been fixed. In this case b/b_0 equaled 0.75 approximately.

Table 6 combined average values of compressive strength, modulus of rupture, and variation factor for periods during which new mixers were used, and Table 7 for periods during which old mixers were used.

Tables 6 and 7 give the strength results at 28 days. Although the report does not point it out, the very high flexural strengths seem worth noting. These ran from 852 to 880 lb. modulus of rupture in the first series and from 883 to 901 lb. in the second. The mix had only a little over five sacks of cement per cubic yard, the proportions being roughly 52% gravel, 31% sand, 11% cement and 6% water. The coarse aggregate is described as a good limestone gravel, and this series is evidence to substantiate the conclusions of the Bureau of Public Roads engineers that higher flexural strengths may be expected from calcareous aggregates.

Uniform grading was assured by using three sizes of coarse aggregate, No. 1, from 0 to 10% on 2½-in. ring and 100% on 1¼-in. ring; No. 2, 0 to 10% on 1½-in. ring and 100% on ½-in. ring; No. 3, 95 to 100% on ¼-in. ring, and 100% on No. 10. The combination was 30 to 35% No. 1, 45 to 50% No. 2 and 15 to 25% No. 3.

Bulk cement was not used at first on one job. But the contractor obtained permission to use it and thereby saved 11c. per bbl.

The conclusions drawn by the report are to the effect that the uniformity and quality of the concrete are just as good with a 35-cu. ft. batch as they are with a 27-ft. batch. A mixing time of 50 sec. was found to be as good as 80 sec. For the conditions, the most economical method appeared to be the use of a 33-cu. ft. batch mixed 50 sec.

Oversanding the concrete was found to increase the cost and lower the quality. By using separated sizes intelligently a lower mortar ratio can generally be used and the cement factor can be reduced.

Charts give complete costs on both the Wisconsin jobs. On one the total cost was $1.451 per sq. yd. This was divided as follows: Cement, 29.61%; gravel, 16.81%; sand, 8.45%; hauling, 6.89%; labor, 8.95%; general, 4.57%; depreciation, 6.93%; repairs, 4.61%; interest, taxes, etc., 2.30%; fuel, 0.66%; avoidable delays, 4.81%; joints, 1.53%; parting strip, 3.65%.

TABLE 6. EFFECT OF SIZE OF BATCH ON STRENGTH OF PAVING CONCRETE

Size of batch	Compressive strength of cylinders at 28 days lb. per sq. in.	Modulus of rupture at 28 days lb. per sq. in.	Average variation Cylinders %	Average variation Beams %	Variation factor within batch %
27 cu. ft.	3594	852	6.76	4.72	3.76
30 cu. ft.	3667	880	5.53	5.39	3.81
33 cu. ft.	3685	872	6.11	5.02	3.70
35 cu. ft.	3790	866	5.92	5.53	3.81
General average	3684	867	6.08	5.16	3.77
		TABLE 7			
27 cu. ft.	3431	885	5.53	3.98	5.08
30 cu. ft.	3516	883	6.84	4.76	5.02
33 cu. ft.	3596	901	5.05	4.78	4.46
35 cu. ft.	3540	901	5.88	4.35	4.69
General average	3518	892	5.82	4.47	4.81

Large Blast Holes as a Substitute for Coyote Holes in Moderate Size Trap-Rock Quarry

Keystone Trap Rock Co., Glenmoore, Penn., Develops Unusual Practice

TRAP-ROCK quarry operations, owing to the seamy nature of the ground, the tough character of the material and in many cases an extremely high quarry face, have gravitated away from well drilling to the coyote tunnel system of blasting, but as a result of a new departure in well-drilling practice, fathered by John S. Galt, president of the Keystone Trap Rock Co., Glenmoore, Penn., there may be an about face in the art of well drilling in trap-rock quarries.

For the moderate size of trap-rock quarry operations, say 1000 tons per day or thereabouts, the system of driving coyote tunnels may be too expensive and tie up too great an amount of money in tunnel and drifting costs. Also, owing to the character of the ground, the tunnel system of shooting may result in too coarse a fragmentation, so that for the comparatively small primary crusher used, an excessive amount of secondary shooting may be necessary, thus adding to the operating costs.

At the Keystone Trap Rock Co.'s operation, at Glenmoore, Penn., the practice up to recently was to drill 8-in. well-drill holes, suitably spaced, augmented with small diameter toe shots to assist in removal of the toe. To do this meant that the face must be cleaned up before the toe holes could be drilled with the conventional tripod arrangement, necessitating a rush at the last moment to get these toe holes in and loaded. It was considered impracticable, on account of the nature of the ground as well as for other reasons mentioned, to use the coyote or tunnel system, so Mr. Galt conceived the idea of putting down drill holes of sufficient diameter to be in reality "vertical tunnels."

This he accomplished by drilling a 12-in. diam. hole, sprung several times and then shot. Surprising information was obtained while drilling this hole, and still more surprising results were obtained after springing and shooting this large diameter hole. From the results obtained by the operators of the Keystone Trap Rock Co. quarry there is some reason to believe that the next step will be the drilling of 16-in. diameter holes, and that churn-drill manufacturers should design their drilling equipment on a heavier scale all around; from a heavier rig, heavier drill stem and bit, larger diameter rope, and perhaps a little more power on the driving unit, so that this trend could be furthered or helped.

At this operation a Super 14 Sanderson-Cyclone, electrically driven, standard 8-in. drilling rig was used, and the only change made was the substitution of a 12-in. bit. The same drill stem was used for the 12-in. bit as was formerly used for the 8-in. one. There was an offset made on the stem where it fitted into the shoulder of the bit. Also the same quality and grade of steel was used in fabricating the 12-in. bit as was used on the smaller diameter steel.

The 12-in. bit was hand forged at the plant within a coal-fired forge. Later an oil-burning forge may be used. The 12-in. bit and stem weighed about 150 lb. more than the previously used 8-in. bit, the stem

General view of the plant of the Keystone Trap Rock Co., Glenmoore, Penn.

totaling 2200 lb. The operators believe that bits and stems up to 3000 lb. in total weight will prove practicable and economical for such type of ground as they are dealing with. Likewise, no change was made in style or diameter of the drilling rope or the drilling speed; the rope remained a 2-in. diameter manila rope and the stroke at 57 per min. Again, no more power was required on the rig, for the 10-hp. motor previously used for the 8-in. holes was sufficient for the larger diameter holes.

One of the surprising features of what in reality was an experiment, very favorable in its outcome, was that the drilling rate, in feet per minute, was found to be a trifle greater with the 12-in. drill than with the 8-in. outfit. This was found to be due to the fact that the larger diameter drill "spanned" the many seams encountered and the drilling progressed at the rate of 3 ft. per day without a single interruption, the bumper or jars not having to be used a single time on the drilling stem. This footage per day is slightly greater than when the 8-in. rig was used. Incidentally, owing to this same condition, it was found years ago that 6-in. holes could not be drilled at all in this ground; or at least the troubles encountered and the incidental costs were such that it was out of the question to use the 6-in. drill bit. The 12-in. holes are drilled to a total depth of 145 ft., which is 7 ft. below the quarry floor.

Not only does the bigger bit straddle the seams, but the greater space left in the drill hole for the stem helps to reduce the troubles of drilling. It will be readily seen that when drilling a 6-in. hole with a 4-in. stem that only 1 in. remains on each side of the stem, so that in seamy trap rock difficulties can be expected. In this case, where a 5-in. stem is used and a 12-in. hole results, there is over 3 in. on each side of the stem for play, so that drilling troubles are reduced. In addition the added weight of the drill and stem are factors in increasing the drilling speed.

Ordinary 8-in. well-drill rig was used for 12-in. bits

Only one such hole so far had been drilled and shot when the quarry was visited in the fall of 1931, and this hole was shot along with four 8-in. holes, the spacing and arrangement of which can be seen from the accompanying drawing. In the future it is planned to drill a single 12-in. hole and, after springing, to shoot it alone. No 8-in. holes will be drilled in the future, according to plans formulated then.

The 12-in. hole was first sprung with one box of 40% nitroglycerine, Hercules powder, with water tamping that covered the charge to a depth of approximately 4 ft. Two boxes of the same strength powder were used as the second springing charge and with the same water tamping. The third spring contained four boxes of powder and 20 boxes of stone dust as the tamping. The fourth spring used eight boxes of powder and 40 boxes of stone dust, and the fifth and final springing charge used 15 cases of powder with 80 cases of stone dust for the tamping.

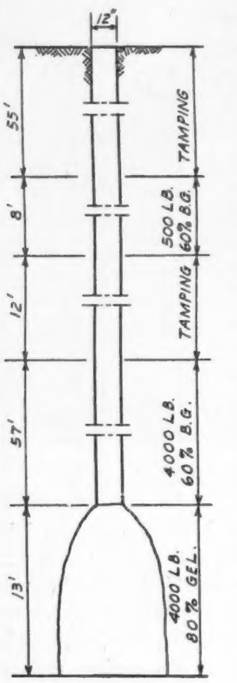
Considerable skepticism was expressed by some that in springing a hole of 12-in. diameter there was or would be considerable raveling and the hole would be ruined. Mr. Galt reasoned that to spring a 3-in. toe hole was common practice. To spring a 6-in. hole was also an every-day occurrence, and his experience with springing an 8-in. hole had been favorable, so why not spring a 12-in. hole also? If the logic applied to one diameter hole, why not all diameters? Of course, the larger diameter the hole, the more thought must be applied to the proper stemming charge, but in essence stemming of any reasonably large diameter hole is practicable if all conditions of ground, character of rock, stemming, etc., are considered, at least so these operators believed.

Mr. Galt stated that in springing and shooting a hole of this diameter the character of the ground and a knowledge of its characteristics are essential to the successful outcome of the springing and that the ratio of

A 12-in. well-drill bit

Close-up of 12-in. bits

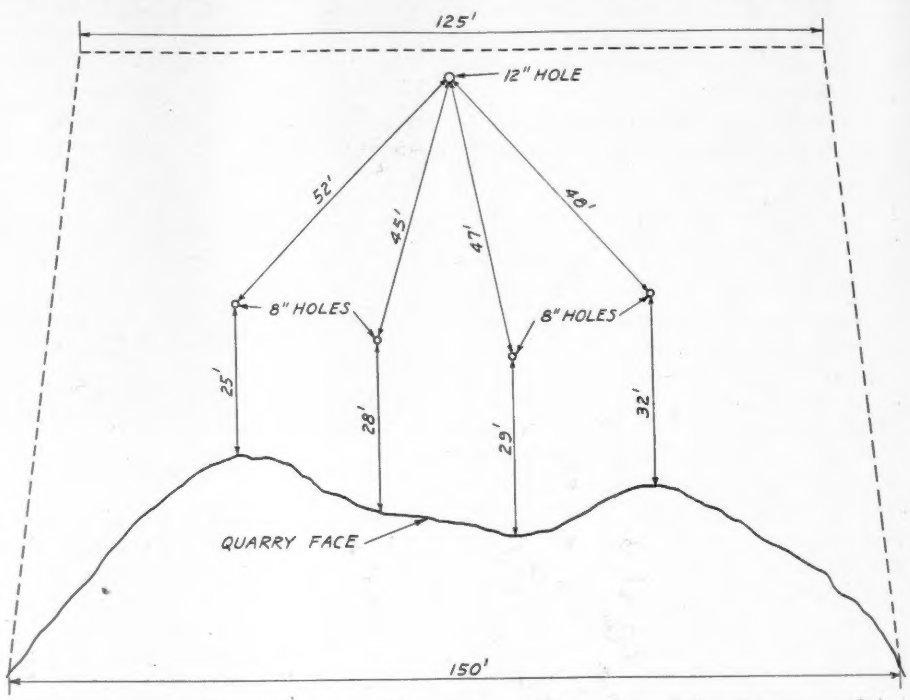
tamping used to the size of the charge should be given due consideration, for otherwise the hole may be ruined. In this case no raveling of the hole resulted. It was noticeable that after the last springing charge had been fired at least three seconds elapsed before the tamping was thrown into the air. In other words, there was the rumble of the exploding dynamite and three seconds later the tamping was thrown into the air at least a distance of 200 ft., showing that the charge had exerted its utmost power in enlarging the hole's diameter.



Section of a 12-in. hole

Between the springing charges no attempt was made to clean out the hole after each springing shot, but after the last spring the hole was repeatedly filled with water and bailed out so that the hole was thoroughly cleaned. Rocks up to 1-in. diameter were bailed out during this process. After the hole had been cleaned out two tons of 80% Hercules blasting gelatine were lowered into the hole. This charge took up 13 ft. of the spring hole. On top of this was placed, without intermediate stemming, 4000 lb. of 60% blasting gelatine, which took up 57 ft. of the hole. On top of this was placed 12 ft. of stone-dust stemming, after which as a deck load 500 lb. of 60% blasting gelatine was placed in the hole. This latter charge took up 8 ft. of the hole and was placed primarily to insure proper breakage of the top. The remaining 55 ft. of the hole was tamped with stone screenings.

The 8-in. holes were not sprung. In the



Plan of quarry blast using one 12-in. hole and four 8-in. holes (not to scale)

General view of quarry showing the inclined stratification and nature of breakage

bottom of each hole was placed 1000 lb. of 60% blasting gelatine, and on top of that was placed 3000 lb. of 40% blasting gelatine. No deck load was used on the 8-in. holes, and the total of two tons of powder used occupied 75 ft. of each hole. Cordeau-Bickford was used to detonate the five holes. Electric exploders were used for the springing charges.

Total Blasting Charge

The shot, as will be seen from the accompanying illustration, was in rather tight ground but gave a wide back-break and shattered the 80,000 tons of stone which resulted from the shot, so that not over 10% would have to be broken by secondary shooting. This was said to be a large improvement over the fragmentation previously secured from the 8-in. holes.

Tabulating the powder charge used, we have the following:

Springing charge, 30 cases		1,500 lb.
12-in. hole		
80% Blasting Gel.	4,000 lb.	
60% Blasting Gel.	4,500 lb.	
		8,500 lb.
8-in. holes, each 1,000 lb. 60% Blasting Gel. plus 3,000 lb. 40% Blasting Gel.		16,000 lb.
		26,000 lb.
Tons of stone secured	80,000	
Tons per pound of explosive	3.08	

While this tonnage per pound of explosive is not high compared with that obtained by some of the larger operations from the tunnel system of shooting using large amounts of explosive, it must be recalled that the expense of drilling and loading is greatly reduced, the amount of money tied up in the tunnel and drifting costs are less and the fragmentation is unquestionably better.

This latter feature is of importance, for this operation is comparatively small, running about 1000 tons per 10-hr. day, and the equipment for loading in the quarry and in the plant is designed for about this tonnage. So that to get economical costs, fragmentation should be such that the two No. 32 Marion steam shovels with 1¼-yd. dippers can readily load to any of the six 5-yd. International motor trucks used in the quarry. The primary breaker is a 36-in. by 48-in. Buchanan jaw with a No. 37 Kennedy-Van Saun gyratory, and a No. 55 Good Roads jaw crusher as secondary crushers.

Contra-Flow Gravel Washer

IN ENGLAND a great deal of ingenuity is being expended in designing combinations of washers and screens for preparing sand and gravel for the market. One of the newest designs, called the Parker washer, is shown here.

As in all contra-flow washers, the feed enters at the end where the wash water is discharged, using the dirtiest water to wash the dirtiest material. This machine is set horizontally and the flow of water through the machine is due to the three circular baffles shown. That at the discharge end, next to the screens, has a small hole, and that at the feed end where the water runs out has a large hole. The center baffle has a hole halfway in size. This arrangement creates a grade which throws the water to the feed end.

The sand and gravel is carried forward against the flow of the water by the lifters shown in the cut.

Screening is by four conical screens which are fastened to the end of the washer drum. Long idler rollers keep the screens from blinding.

The purpose of such machines is to reduce first or installation costs by putting the whole plant in one machine. But this means sacrifice of capacity or efficiency if the output is carried beyond a certain quantity. The design of the screening portion is not good. The largest screen area is given to the coarsest screen instead of to the finest. The diameter of the outside screen is three times that of the inside screen. One would judge that if the fine, outside screen was run slowly enough to do good screening the capacity of the washer would be greatly decreased.

Cracking of Asphalt Pavements

F. J. LADUC, consulting engineer of Montreal, Canada, described a study of cracks in Montreal pavements to the Association of Asphalt Paving Technologists at its Detroit meeting. The cracks were classified and each class was studied. But it was found that at least 9 out of 10 cracks could be traced to some weakness in the base. The paper says it is not certain but that the explanation might hold true for all ten if time had been given for a thorough examination of the concrete base on which the other cracks were found. This base was 1-3-6 mix and 6 in. thick except for one stretch of 9 in.

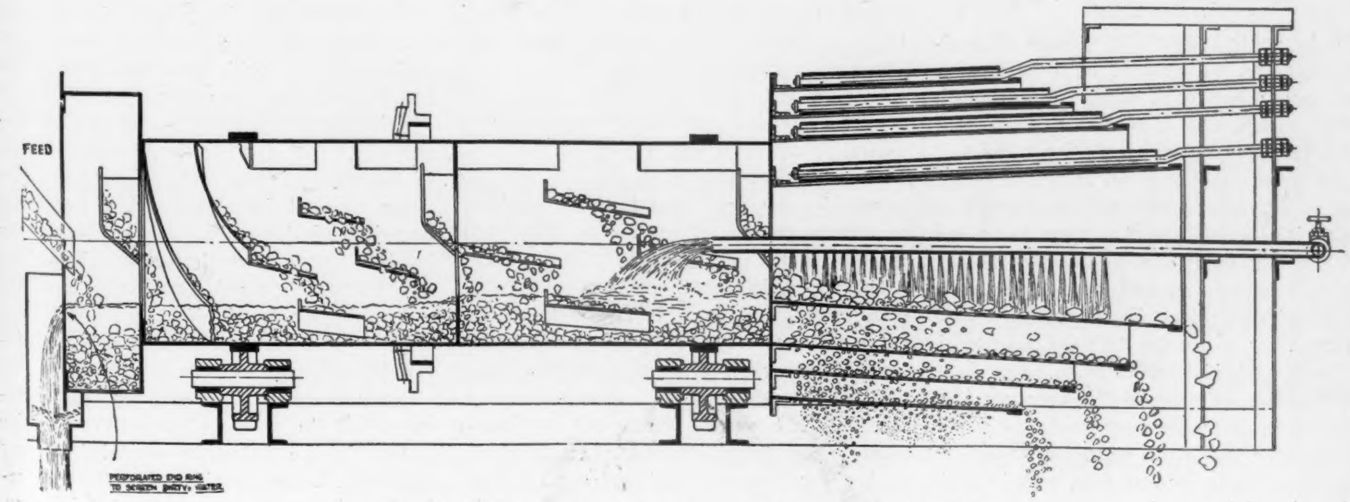
A local factor is that most streets in Montreal are laid on low bearing capacity soils. Few cracks were found where the pavement was on rock or close by rock.

Laboratory experiments were made by freezing 10x8x2-in. slabs, molded under 800-1500 lb. pressure. They were held two months at 0 to 20 deg. F. When removed from the refrigerator no cracks had developed although the slabs were brittle. After being kept two months the slabs were exposed on a roof. Cracks developed in some slabs but in all cases these slabs did not rest evenly on the roof. The paper appears to conclude that the study and the tests indicate that all cracks are related to uneven support.

Stability Tests for Bituminous Mixtures

THE Hubbard-Field stability test, which was originally designed to test sheet asphalt mixtures, has now been modified so that it can be used to test asphaltic concrete and other materials with large sized aggregate.

The modifications, a special mold and testing ring, and results of tests of various mixtures, were described by Prevost Hubbard in a paper delivered before the Association of Asphalt Paving Technologists at the Detroit meeting.



A British design of a contra-flow sand and gravel washer

Volume Delusion in the Cement Industry

By J. C. Buckbee

J. C. Buckbee Co., Engineers, Chicago, Ill., and Vice-President of the Petoskey Portland Cement Co.

THE EDITORIAL in the April 23 issue of Rock Products commenting upon the suggestions of the Federal Trade Commission and *Engineering News-Record* for stabilization of the cement industry gives rise to some thoughts that may be helpful to those who are studying this grave problem.

It seems certain that one major cause of our present depression lies in our failure to profitably market the great quantities of useful commodities we have learned how to produce, and that this fault exists largely because our marketing practices are hampered by the age old traditions of "Barter and Trade"—in other words, the meeting of the minds of the buyer and seller as to a value.

I believe all will agree that such a practice of establishing values is not a sound foundation upon which to place modern industry, with all its intricate complications and interconnections, and that until we largely abandon such a practice and get to the sound foundation of "cost" as a basis of price, we cannot help but have unhealthful booms followed by serious depressions.

As volume is reduced in a manufacturing plant, costs increase, and it is only natural, therefore, that a manufacturer seeks to keep his plant running at high capacity and is often willing to make a concession in price to get tonnage.

As I pointed out, however, in my article, "The Volume Delusion" in the April 23 issue of Rock Products, concessions in price to secure tonnage may lead to less rather than more profit, and reductions in tonnage may not so seriously affect cost as one might think.

Restraint and Moral Courage All That Is Required

To be content with the volume of business that can be secured at a fair price, based upon one's cost, often requires much moral courage, but it is without doubt the surest road to profits. By being content, I do not mean relaxing at all in efforts to get business or reduce costs and merely riding along with the business that flows to us and with existing costs, but I do mean *taking only such business as will show a profit.*

Theoretically, prices should rise as volume decreases, for is not the "servant worthy of his hire"; and, if it costs more to produce a commodity, why should the user not pay more for it, since the user needs the commodity or he would not purchase it; and if the producer sells for less than cost, he will in due time fail and the user will have no source from which to obtain the commodity he needs.

J. C. Buckbee

Practically, of course, we cannot raise prices as volume decreases, for age-old tradition decrees some lowering in prices as business recedes, on the theory that a better price attracts the buyer. As a matter of fact, a lower price does exactly the reverse, for it is only human nature to defer purchases on a falling market in the hope of still lower prices. Therefore, sales made in a falling market are necessarily forced purchases and not purchases induced by an attractive price—at least so far as the commodities we are discussing are concerned.

In line with the "Traditions of the Past," business starts receding as prices start falling, and continues to recede with still further price reductions until people note such bargains in commodities and property, that capital is attracted and the trend reverses. Then, as prices start rising, people see opportunities for profit and business quickens as orders are placed for commodities, and more men are put to work. Then always comes the period when people see visions of great profit, and, in their efforts to realize these visions, compete in the market for goods, causing prices to rise to levels that yield unjustified profits to manufacturers; but at such times the buyers are not interested in the fairness of the price they are paying, for they are convinced that, if they can only get the goods, they can realize their vision and their profit. What the other fellow makes does not concern them.

When manufacturers make undue profits, others are induced to go into business and money for new enterprises is readily obtained, for in such periods people are dealing in visions, not facts. In time, the new factories make more goods than the market needs, price concessions are made to secure orders, and business starts on another decline, to go through another cycle.

Had we the moral courage not to reduce prices to secure orders and not to raise prices when the opportunity offered, the rise and fall of our business activity would be reduced to comfortable fluctuations reflecting the normal variations of demand for our product.

Please Study Effect of Volume on Cost!

It will, of course, be many years before such a happy state of affairs can exist, for the human mind moves very slowly and we are all shackled to the "Traditions of the Past"; but it would seem self-evident that we can do much to avoid another such set of disarranged economic conditions as we are facing today, by devoting more study to what real effect reductions in tonnage have on our costs and holding to a policy of refusing to sell below cost.

Deluding oneself into thinking that more than one's fair share of the available tonnage may be secured by reducing the price is the rankest sort of folly, as actual experience has repeatedly proven. If a manufacturer reduces his price and takes a portion of the tonnage fairly belonging to a competitor, the competitor is sure, sooner or later, to reduce his price still more in an endeavor to regain the lost tonnage. This, in turn, takes an order from some one else, who repeats the action, and in due time the man who started the price-cutting party finds some one in his back yard making far lower prices than he never dreamed of.

Price cutting as a temporary expedient to get over a soft spot is a delusion and a snare of the most vicious sort. Such a practice never resulted in anything but a general lowering of the price. No one was ever brilliant enough to devise a scheme for smoke screening a price cut, or to avoid the evil consequences of his act. In cutting a price, a man bets against the field and invariably loses in the end.

Since the cement industry appears to present about the most serious picture of price cutting in the industries served by Rock Products, let us consider the effect of reduction of tonnage on costs in that industry.

Let us take the figures for cost of cement manufacture given on pages 54 to 55 of the January 9, 1932, issue of ROCK PRODUCTS, as they seem to be well in line with actual experience.

The cost of cement in the bins is set up in this article as 60c. per barrel. If we add 10c. per barrel to cover the cost of packing and loading, the cost on cars is 70c. per barrel, and, for the sake of argument, let us say this cost can be pretty closely maintained from 80% of normal capacity up to 110% of capacity. By normal capacity I mean that rate of output that can be comfortably maintained over long periods with maximum fuel economy. By 110% of capacity, I mean the capacity that is secured by forcing the mill and sacrificing fuel for output. Then, if we take $1.20 per barrel as the total cost at normal capacity, it is obvious that the fixed cost is 50c. per barrel, or, say, 40% of the total cost.

Now, let us say we have a mill that will produce 4000 bbl. per day at normal capacity and see what effect reductions or increases in tonnage have on the cost. At normal capacity we have the following daily charges:

Manufacturing expense 4000 bbl. at 70c.	= $2800.00 daily
Fixed charges 4000 bbl. at 50c.	= 2000.00 daily
Total	$4800.00 daily
Or	$ 1.20 per bbl.

Now, say, we step up production to 110% of normal capacity, or 4400 bbl. per day, and, for the sake of argument, leave manufacturing cost constant at 70c. per barrel. Then we have the following picture:

Manufacturing expense 4400 bbl. at 70c.	= $3080.00 daily
Fixed charges (as before)	= 2000.00 daily
Total	= $5080.00 daily
Or	$ 1.15 per bbl.

Now, say, we reduce capacity to 80% of normal capacity, or 3200 bbl. per day, and again, for the sake of argument, leave manufacturing cost constant at 70c. per barrel. Then we have the following picture:

Manufacturing expense 3200 bbl. at 70c.	= $2240.00 daily
Fixed charges (as before)	= 2000.00 daily
Total	$4240.00 daily
Or	$ 1.33 per bbl.

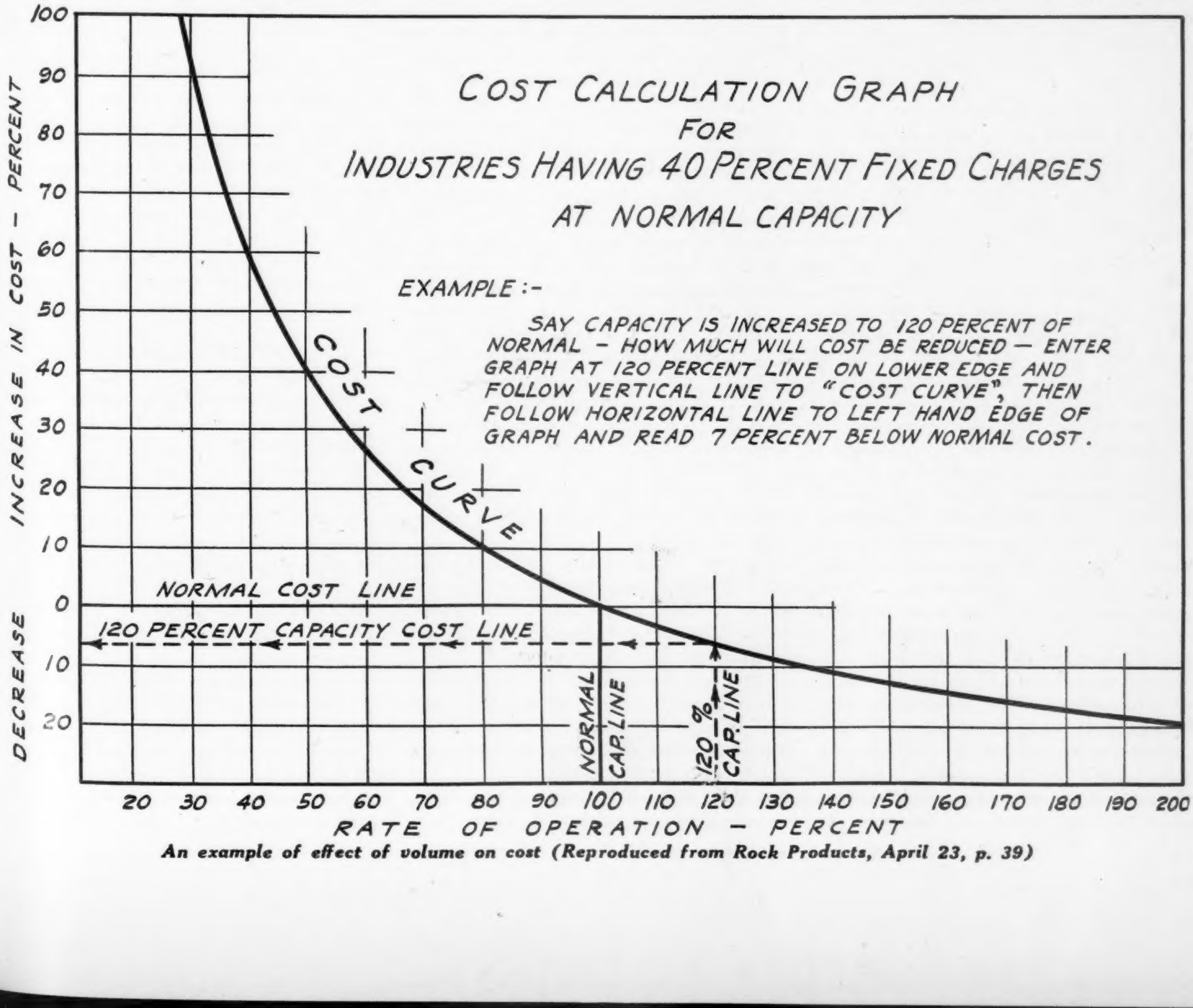
Neither of above estimated costs are truly accurate, for it is only human nature to be indifferent to minor economies when the mill is running at more than normal capacity; and fuel costs would increase as the kilns were forced for high production; while, when business falls below normal, we all pay most careful attention to minor economies, and fuel costs would probably be even lower than normal. Therefore, the cost of $1.15 per bbl. for 110% capacity is probably quite a little lower than we would actually realize, while the cost of $1.33 per bbl. for 80% capacity is undoubtedly higher than the actual cost would be. However, for the sake of argument, let the figures stand, since the 30% difference in capacity represents almost the exact drop from the peak year of 1928, when shipments were 176,000,000 bbl., to 1931, when shipments were 127,000,000 bbl.

From the above calculations it appears that the increase in cost for a range of 30% in capacity would be but 18c. per bbl., providing labor, fuel, supplies and operating efficiency remained constant. As a matter of fact, labor, fuel and supplies were materially lower in 1931 than in 1928, and operating efficiency was undoubtedly much higher; so the actual increase in cost was probably not over 10c. per bbl. at the most.

In the same period the average selling price at the mill dropped from approximately $1.60 to $1.10 per bbl., and we hear of large contracts being taken at 46c. per bbl.

Excess Capacity Not Necessarily Cause of Cut Prices

The statement is frequently made that excess capacity in the cement industry is alone responsible for the drop in prices. *Business Week* of April 13 states that but 46% of the capacity of the cement industry was used in 1931. If that figure be taken, then but 63.5% of the same capacity was used in the peak year of 1928, and, while the figures may not



An example of effect of volume on cost (Reproduced from Rock Products, April 23, p. 39)

be truly accurate, it appears certain there was much so-called "excess capacity" in the peak year of 1928, when prices were at a profitable level.

Therefore, it would seem we cannot fairly ascribe the drop in prices so much to "excess capacity" as to the lack of appreciation of what influence the rate of production has on cost; or, shall we say, to the *fear* of a material rise in cost with reduced tonnage. It would seem that much of this fear could be removed if cement men analyzed their costs along the lines suggested above.

Business Week of April 13 also gives an estimate showing that the cement companies of the United States lost $25,000,000 in 1931, while enjoying a tonnage of over 70% of their all-time peak-year tonnage. In other words, it cost some 20c. per bbl. more to produce the cement than it was sold for.

The five year (1927 to 1931) average rate of operations for the steel companies of the United States was 80% of capacity and the average price for their product for the same period was $35.12 per ton. The price during recent weeks, with operations down to around 20%, is $29.81 per ton, or but 15% less than when the producers were able to operate at 80% capacity.

The steel man's problem of fixed charges and tonnage is identical with that of the cement manufacturer, but the steel manufacturers seem to have appreciated that business cannot be induced by cutting prices, and have only lowered their prices slightly to conform to tradition, even though the available business permitted them to operate at but 20% of capacity.

Had the cement industry taken a similar view and reduced prices last year but 15% below the 1928 prices, it appears, in the light of the above computations, that the cement industry would have made $10,000,000 last year instead of losing $25,000,000.

* * * * *

Where variables are to be considered, curves present the picture more clearly and quickly than computations. The appended curve shows the variation in cost for industries having 40% fixed charges at normal capacity. While the curve has been extended down to 30% of normal and up to 200% of normal, so as to permit its use in many industries, the trend of the curve up to, say, 120% of normal will only be of interest to cement men in considering their own problems. The slope of the curve for actual costs would be flatter than the graph shows for, say, 50% of capacity and upwards; in other words, the variations in cost for the different capacities would not be as large as the graph indicates; for, as stated above, it is only human nature to be indifferent to small economies when the mill is running at high capacity, and to pay strict attention to all economies when running at low capacity. Besides, in a cement plant fuel costs per barrel would be increased as the kilns were forced for high tonnage, and the curve assumes uniform production cost per barrel at all capacities.

For those whose fixed charges are above or below 40% at normal capacity and who wish to compute their costs at other than normal capacity and plot a curve to show the effect of tonnage on their own costs, I would advise that the following simple formula will give them the picture:

$$X = C + \frac{100 \times F}{P}$$

Where

X = Total cost in cents per barrel.
C = Direct production costs in cents per barrel.
F = Fixed cost in cents per barrel at normal capacity.
P = Rate of operation expressed as a percentage of normal capacity — that is, normal capacity is taken as 100.

Example:

Say total cost at normal capacity is $1.25 per bbl. and consists of 80c. direct production cost and 45c. fixed cost. What will cost be at 90% capacity, assuming no economies are effected?

$$X = 80 + \frac{100 \times 45}{90}$$
$$= 80 + 50$$
$$= 130\text{c. or } \$1.30 \text{ per bbl.}$$

Relation Between Strength of Cement and Strength of Concrete

F. H. JACKSON, United States Bureau of Public Roads, writes in the January issue of *Public Roads* on the variations in concrete due to variations in the quality of cement. Eight brands bought in Washington were tested. Potomac river sand and gravel was used as aggregate.

The average compressive strength at 28 days was 2414 lb., which is close to the theoretical strength figured by Abrams' formula, $S = \frac{14{,}000}{7x}$, the water-cement ratio used being 0.95. But the range was from 2005 lb. to 2775 lb., the difference being about 26%, which the paper says would about equal the strength decrease that would come from using one gallon more per sack with the cement giving the highest strength. This shows, as the paper says, "that the quality of the portland cement may have a rather marked effect on the 28-day strength of the concrete."

Although the paper does not note it, the tables show that the difference of 26% had shrunk to 18.5% at the end of six months and to 14% at the end of one year. And the high and low cements at the end of six months were not the same as at the end of 28 days. The relative positions were entirely changed. Cement H was highest in flexural and compressive strengths at 7 days and 28 days, but at 6 months it was in the sixth place. Cement C, which had the eighth, the lowest place, at 7 days and 28 days, had the highest place in flexural and compressive strength at the end of 6 months. Running through the column of flexural strengths at different ages, it is evident that those cements which had the higher strengths at 7 days and 28 days had the lower strengths at 6 months and 1 year, although the difference in strength was not so much.

The briquet tension tests of the various cements agree pretty closely with the 7-day and 28-day strengths of the concrete made from them. But all relationship between briquet strength and concrete strength ceases after 28 days. The paper says that this is in agreement with available information on the subject, which indicates that cements that give relatively low briquet strengths at 7 days and 28 days may show as high concrete tests as the cements which give high briquet tests at 7 days and 28 days.

In this series the paper notes that there was a general retrogression of strength in all the briquets tested at 3 years, and in some cases at earlier periods. The tendency is not reflected in the concrete tests, so it is ascribed to some factor common to all specimens, such as type of specimen or conditions of storage.

The conclusion drawn is that the tests indicate that briquet strengths are no indication of concrete strengths at 6 months and over, but that the 7-day and 28-day strengths of briquets do indicate in a general way the strengths that will be developed in concrete at corresponding periods.

"L'Age du Ciment"

L'AGE DU CIMENT (*The Cement Age*) is a technical bulletin issued by the Société Anonyme des Chaux et Ciment du Lafarge et du Teil, one of the best known makers of cement and limes in Europe. The first part deals with the manufacture of cement and limes in a general way and the last part with their utilization in mortars and concretes in making structures of plain and reinforced concrete, concrete products and the like.

The products of the Lafarge company include hydraulic lime, grappier cement, natural cement and artificial cements. This last is used as a class name to include ordinary portland, double-burned cement, white cement, alumina cement (which is called ciment fondu) and "superciments," the name given on the Continent to what are called high-early-strength cements in this country. The book says regarding these that present-day cement factories have so improved their ordinary portland products that "the transition from ordinary portlands to 'supers' is absolutely insensible."

In the second part of the book considerable space is given to precast products, especially concrete piles, posts and poles; among the illustrations are some beautiful light designs of poles for holding high-tension wires. The final section is an unusually good explanation of the design of concrete mixes.

Predicting the Mortar Strength of Sands

Reviewed by Edmund Shaw

Contributing Editor, Rock Products

THE Maine Technology Experiment Station has issued its Bulletin No. 27, which is entitled "Predictions of 28-Day Tensile Strength of Sand Mortars from 1-Day Information." It is a summary of the well-known work of this station, under the direction of H. Walter Leavitt, a research which has extended over 10 years. The previous bulletins, Nos. 23 and 24, which showed that prediction was possible to a high degree of correlation, were reviewed in ROCK PRODUCTS, June 21, 1930.

The reviewer has heard the criticism made that this long and exhaustive research has led to little of practical value. But he believes that it has led to results of the highest practical value. The mere ability to predict the mortar strength of a sand may not be so important, since with a *known* sand this may be determined rather closely by applying well-known factors to the gradation. But the study has brought out that mortar strength appears to be affected by variables due to chemical composition that were not known, although they may have been suspected, before.

Based on Hundreds of Tests

The work was done by applying statistical methods to data from hundreds of tests made by the experiment station with the cooperation of the Bureau of Public Roads. The explanation of the method would be too involved to give here. It is enough to say that the result of such work is a decimal fraction which expresses accurately the degree of correlation between what is predicted and what is actually found. One authority gives the following values to such coefficients: 0-0.20, negligible correlation; 0.20-0.40, correlation is present but of a low degree; 0.40-0.60, marked correlation, and above 0.60, a high degree of correlation. The correlation coefficient with the latest work is 0.822, which indicates a high degree of correlation, even though a few predictions are very low. The average error on 61 samples which averaged 450 lb. tensile strength was 57.7 lb. The average predicted strength was 408 lb. In considering all this work it must be remembered that overproduction was always guarded against. Only 16 of the predictions were too high, and then only by small amounts. The failure to predict closely in every case but one was with samples which gave very high tensile strengths, from 550 to 650 lb. If allowance is made for these the error is considerably reduced.

In the beginning of the research the variables of fineness and surface modulus were studied. The correlation coefficient was low, only 0.28, indicating that 96% of the original variability in the sands was accounted for. This bears out the work of other investigators, who have found that with any particular aggregate the strength varied with the fineness modulus, within limits, but that two sands with the same fineness modulus (or surface modulus) rarely gave the same mortar strength. Then the sieve analysis, organic impurity tests, mineralogical analysis, and shape of particles were studied in connection with the fineness modulus and surface modulus, samples coming from hundreds of pits from all over the state.

The results were disappointing, the correlation coefficients being very low. It was judged that there might be three reasons for this: That the cause of strength had not been discovered; that it was known but not measured properly, and that the whole plan of testing was useless, as strength was an uncontrolled and uncontrollable variable. That the variables affecting strength were not measured properly seemed to be the solution of the problem.

Four years' work had to be thrown away and a fresh start made. It was found for one thing that the sieve analysis of the general sample did not represent very closely the analysis of the sand of the test specimen, so the sieve analysis of each batch of sand had to be made before it was tested. The other work of testing was carried out with more care and the U. S. Bureau of Public Roads was asked to test 100 Maine sands in tension and compression. From all this work it was found, as published in Bulletin No. 7, "that the variation due to materials, methods of curing, fabrication, etc., is 71%, the remaining 29% being due to variables which affect differentially briquets of the same test sample." For compression the figures were 39 and 61%. Tensile tests were chosen because in all kinds of failure there must be separation of particles. An improvement on the usual test for organic matter was devised, which gave much more accurate results, necessary because the amounts of organic matter were usually small.

Effect of Chemical Elements in Sand

It was then decided to study the effect of chemical elements, for it was shown that some sands gave high mortar strengths with one cement and low strengths with another. The extreme case was a sand that gave a strength of 195 lb. with the first cement tried and 425 lb. with the second. This caused considerable comment when it was published. (See the review in ROCK PRODUCTS, June 21, 1931, for further details.) The cement used by the Maine station gave high results with limestone sands, while low results were obtained with the cement used by the Bureau of Public Roads. A chemist was engaged and methods of chemical analysis devised adapted to sands containing small amounts of iron, alumina, calcium and magnesium. These methods, given in detail in the bulletin, were applied by leaching with dilute hydrochloric acid, as leaching with water did not dissolve efficiently substances that acted as variables. A correction for a change in the stock cement used had also to be made.

Equation Developed

The equation finally developed takes into account the strength of the cement, the grading of the sample, the organic impurity, no matter how small, and the percentages of water used and the iron alumina, lime and magnesia found by the methods given. These are all expressed as percentages and multiplied by a constant with either a plus or a minus sign, according to whether the factor increases or decreases strength. Thus the plus 8-mesh is multiplied by +8.1392, as increasing strength, while the plus 14-mesh is multiplied by —0.6820, as decreasing strength. The color plate has a minus factor and all the chemical elements found have plus factors. The equation is: 28-day tensile strength equals 308.22 + 8.1932 (8-mesh) — 0.6820 (14-mesh) + 0.5870 (28-mesh) — 0.1131 (100-mesh) + 1.1802 (P-100-mesh) + 0.5288 (% H_2O) — 41.8604 (color plate) + 8.6658 (% Fe) + 19.4487 (% Al) + 1.1011 (% Ca) + 103.2323 (% Mg) (Eq. No. 3, p. 30). The equation appears cumbersome but is readily applied by using tables which have been prepared. It is in regular use for predicting the mortar strengths of Maine sands to be used in making concrete highways. The bulletin says that further research is needed before more accurate results may be obtained.

Liming and Soil Fertility

POT AND FIELD experiments were conducted by S. S. Yarusov on a podsol soil with lime applications equivalent to 0.5 of the hydrolptic acidity, equal to the hydrolytic acidity, twice and four times the hydrolytic acidity. The results—in terms of yields—were followed up for four years. The lowest lime application was slightly effective as shown by the yield and saturation with Ca. The medium lime application was definitely effective during the four years. The higher lime applications gave very high yield increases during the first two years, followed by a rapid decline. These changes were similar in the field and in the pots, but not so clearly defined in the field. Along with the yield increases there was a higher utilization of P_2O_5 and N as indicated by the analyses of the plants. The tests were made with oats, barley and clover with and without a complete fertilizer.—*Chemical Abstracts.*

Gasoline-Engine Powered Dredge for Very Shallow Water

Hawkeye Material Co., Iowa City, Ia., Has a Specially Designed Plant with Unusual Features

WHEN C. E. Thomas, president of the Hawkeye Material Co., Iowa City, Ia., decided to build a new dredge he incorporated into the design many novel features. Ideas that he had gathered during the many years in the sand and gravel industry were crystallized in the construction of this small but efficient suction dredge.

A primary object of the designer was to keep the cost of the dredge at a minimum, as well as to design one with as low a power and operating cost as possible. The dredge also had to have sufficient buoyancy, as the Iowa river at Iowa City is very shallow.

Screening, washing and crushing plant is built on same hull as dredge pump

At the outset Mr. Thomas sent to Oregon for timbers 100 ft. long to be used for the side structure of the dredge. By using unspliced timbers he was able to obtain a rigidity that he otherwise would not have been able to obtain without the use of much more timber. The dredge hull is of wood construction throughout and measures 100 ft. in length, 24 ft. wide and 50 in. deep. A little more than half of this deck area is occupied by the drive equipment and the gravel pump. He uses an 8-in. Bennett pump belted to a 90-hp. Waukesha gasoline motor.

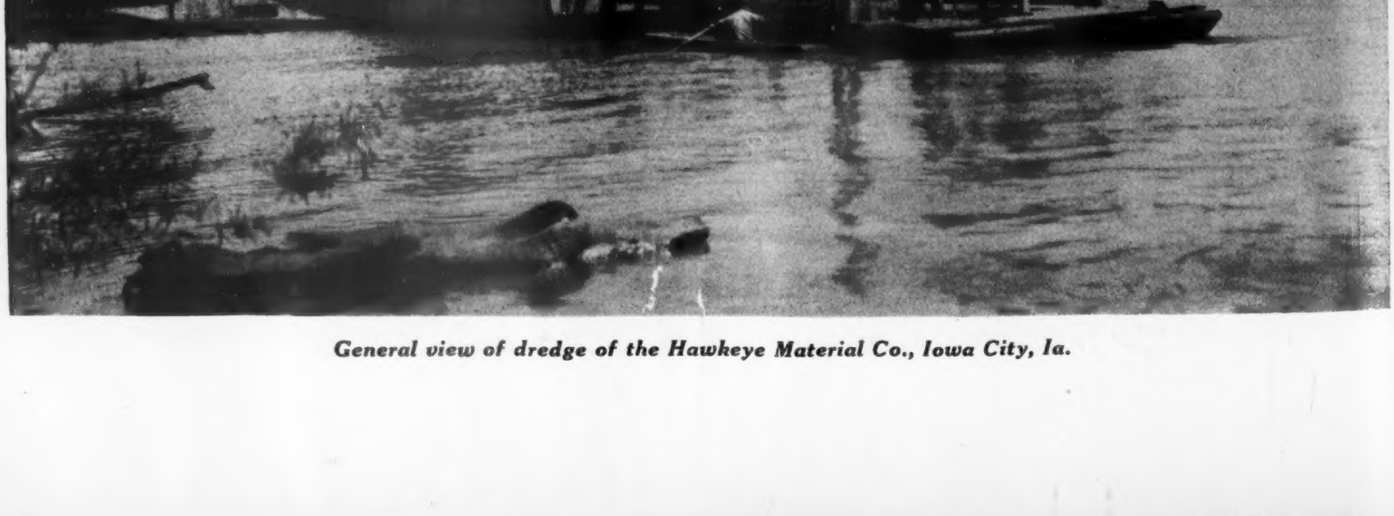
All of the other various small units requiring power, both in connection with the digging operation and the washing plant, are electrically driven. Power for these units is developed by a second 90-hp. Waukesha motor direct connected to a 60-kw. Electric Machine Co. generator.

Owing to the presence of boulders in the glacial gravels of the Iowa river the oversize has to be crushed. The suction head is also provided with an Eagle Swintex cutter. The river at that point runs about 25% gravel, of which about half has to be crushed. An 8-in. by 24-in. Universal jaw crusher is used for this purpose.

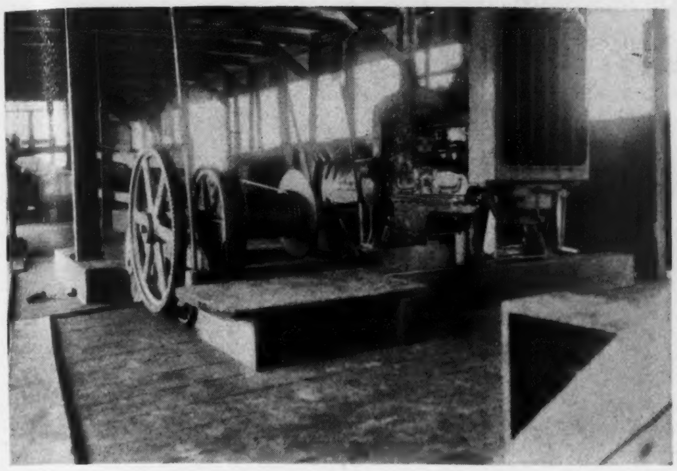
In laying out the design of the dredge it is notable that the designers have allowed ample room between the various units, making everything easy to get at for repairs, as well as to tone up the general appearance of the craft. All of the electric wiring is in conduit, which for a small dredge is unusual, but is insurance against fire and accident to workmen.

At present the dredge is working about 1600 ft. below the company's yard at Iowa City, and the washed sand and gravel is transported to the yard on small wood hull barges, each barge holding about 90 tons. A 120-hp., stern-wheel towboat is used for moving the loads upstream to the yard. The motive power for the towboat is a gasoline engine taken from a Holt tractor, and it has proven very satisfactory for the work.

Mounted on the aft deck of the dredge is the washing and crushing plant. The pump delivers to a rotary screen, with the



General view of dredge of the Hawkeye Material Co., Iowa City, Ia.



Gasoline-engine driven pump surrounded by ample floor space for repairs, etc

Gasoline-engine driven 60-kw. generator supplies power for all auxiliary equipment

Left, J. F. Sproatt, general manager of the River Products Co., Iowa City, and right, C. E. Thomas, president of the Hawkeye Material Co.

oversize falling to the jaw crusher as previously mentioned. Eagle washers are used for removing waste materials, after which the products are chuted to barges.

One grade of sand is made in a Telsmith cone. If mason's sand is wanted it can be recovered from the rejected material that has been left by the dredge. The dredge has a capacity of 600 tons per 10-hour day. The two engines were said to burn 125 gal. of gasoline per 10 hours.

The power from the 60-kw. generator is used as follows: 25 hp. for the crusher; 7½ hp. for the washer (Eagle); 5 hp. for the bucket elevator; 7½ hp. for the rotary screen. The remaining excess power is for the primary pump, etc., on the dredge. A 550-g.p.m. Fairbanks-Morse pump is used for this purpose.

The dredge was built late in 1930 under the direction of C. E. Thomas, president of the Hawkeye Material Co. George Thomas is vice-president and treasurer, and Gladys Thomas, secretary. The offices of the company are at Iowa City. C. E. Thomas is also general superintendent of the Ideal Sand and Gravel Co., Mason City, Ia., one of the largest producers in the state.

Sand and Gravel in 1930

STATISTICS on the sand and gravel industry in 1930 have been published by the Bureau of Mines. The report states that there was a decrease of 11% in quantity and 13% in value of sand and gravel output in 1930 as compared with 1929. Paving gravel was the only class of materials to increase, the increase amounting to 7% more in quantity but 3% less in value. Glass sand decreased 17% in quantity and 15% in value. The decrease in molding sand amounted to 46% in quantity and 45% in value, being less than any year since 1921. Building sand decreased 18% in quantity and 19% in value, and building gravel decreased 13% in quantity and 10% in value.

The total output of sand in 1930 amounted to 83,658,618 short tons, valued at $49,721,553, a decrease of 16% in quantity and 18% in value as compared with 1929. The total output of gravel amounted to 113,393,108 short tons, valued at $65,454,990, a decrease of 8% in quantity and 9% in value from 1929.

Finely ground silica sand for use in paint, pottery, fillers, and similar products are not included in this report but are discussed in the chapter on silica in Mineral Resources of the United States.

Ochers and Mineral Pigments

A RECENT BULLETIN, No. 304, issued by the Bureau of Mines, contains a review of the nomenclature, sources, imports, statistics, common methods of preparation, and testing of mineral pigments. It also gives a description of the Deer Park-Spokane colored-clay district and the laboratory methods of preparation of these colored clays, ochers and siennas.

In the summary it is said that the Deer Park ocher is one of the few that have color comparable to the French ocher for the paint trade. While its color is not identical it has a similar bright yellow appearance and will even stand a better dilution test than the French. Certain disadvantages are pointed out regarding the operation of these deposits. It would be possible for a single company operating in eastern Washington to produce the ocher yellows, the sienna browns, and the paint pot reds by simple grinding methods and by calcination the brighter reds, darker browns and blacks could be produced. It is believed that the total available tonnage in this area is very large, the bulletin states.

Influence of Aggregates on Strength of Concrete

WATER-CEMENT RATIO, workability and tests for organic matter are discussed in a report by Miguel Villa on the influence of aggregates on the strength of concrete. Data showing the reduction in strength due to organic matter are presented. Sugar is often present in Cuban sand, and tests have shown that 0.25% is sufficient to cause disintegration of concrete. Characteristics of coarse aggregates and effect on strength are discussed.—*Chemical Abstracts.*

Lime Production Methods of Europe and America

Part X—Mixed Feed Kilns (Continued)

By Victor J. Azbe
Consulting Engineer, St. Louis, Mo.

SOME of the objections to tall kilns are that they cost more; have more masonry in them; rock and coke have to be hoisted higher; and have greater outside radiation; but all of these disadvantages are almost always outbalanced.

Fig. 119 represents a more modern type mixed-feed kiln of modest size. The shaft is practically straight, tapering only slightly. It is slender and generally entirely different from the two in Fig. 115. The kiln is of induced draft type, is charged through double bells to prevent diluting the gases with excess air, and is automatically drawn.

For best results with mixed-feed kilns the stone should never be above 8 in. and the coke of egg size. Charging should be such that large stone is in the center and small stone along the walls. There should be no coke against the walls for, say, a distance of 10 in., and little in the center. Small stone against the walls and no coke is, however, emphatically the most important. In Fig. 120 Berthold Block pictures his idea of proper charging. But as the mechanical charging of two substances of different size and specific weight is far from simple, numerous systems have been developed.

Fig. 119. Modern kiln of medium large capacity

In the operation of mixed-feed kilns the air supply should be large enough to assure absence of carbon monoxide in the waste gas without excessive amounts of excess air. In this respect it is possible to control the mixed-feed kiln within very narrow ranges, as shown in Fig. 108.

The drawing of lime must be at a high enough rate to assure an ample preheating zone for the stone. Slow drawing causes the fire to reach high up into the kiln and results in high waste gas temperatures. The kilns therefore often have numerous small observation holes for observing the location of the hottest zone and of its terminals.

In some cases, in small plants the kilns are drawn and charged only in daytime and left to themselves during the night. This is possible only in the case of mixed-feed kilns. No other kiln could be ignored for 12 hours or longer at a time. However, even a mixed-feed kiln suffers when so operated. From a labor standpoint it is all right, in other respects it is all wrong, for there is no uniformity, the first lime drawn being cold and the last very hot. At one time the air is preheated too much, at another not enough. Gas coming from the kiln fluctuates from cool to intensely hot. Half of the stone is not preheated right and the hot zone is first here, then there, and the kiln walls, instead of being at a constant temperature, are continuously fluctuating in temperature.

Frequent draws during the day and night followed by immediate charges is far better. Still better, is continuous mechanical drawing. The advantages of continuous drawing of mixed-feed kilns are much greater, also more practical than with gas-fired vertical kilns. The objection, of course, is the high cost of good draw mechanisms.

As in the case of charging devices, there are also draws and draws of all kinds, enough to fill a book, which we will slide over in a hurry for lack of space.

Gerhardt Seeger, the noted German kiln expert, said that there are a few good ones and that the one designed by Sobek is one of them; also that even the best automatic draws break up the lump lime to an extent. Their cost in Germany is from $6000 to $9000 for a 100-ton kiln, which he claims is too much, as he could readily hand-draw, with the help of a conveyor, 100 tons of lime in a day with three men. He also said that no automatic draw does its work just right; it's not natural, because it has no brains. His preference appears to be the Donauwerke System shown in Fig. 121. Still, in Germany and in England automatic draws are a common thing, even though labor costs are much lower there than here.

One of the better draws was designed by G. Polysius and is shown in Fig. 121. This one is designed for as small breakage of lumps as possible. Others by Kurt von Gruber were shown previously.

If the capacity desired is large enough and conditions are such that there is an economic justification for it, then a mixed-feed kiln plant can be mechanized to the exclusion of almost all manual labor. The proportioning of stone and coke and the charging of the mixture can be done and is being done without any other labor except that necessary for

Fig. 120. Improvements in kiln charging suggested by Block

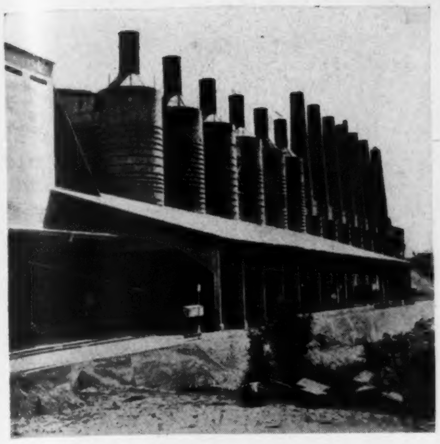


Fig. 122. Bavarian kilns of large capacity

periodic checking of charges and for control of distribution to various kilns. The drawing also can be equally mechanized. All that is needed is supervision, because, as Herr Seeger says, there is a lack of brains in a lump of steel even when perfectly formed.

No kiln, except the rotary, has such a wide range in possible high capacity as the mixed-feed kiln. If one desires a 5-ton mixed-feed kiln, it can be readily built; if one desires a 250-ton lime kiln it can also be built almost as readily. This was not so always. It is only in the last few years that the high air blasts were applied. Now there are kilns operated with forced draft with the startlingly high blast pressure of 18-in. water gage. In 19 hours from the time the stone enters the kiln it is lime in the railroad car, while in some other plants where kilns are operated under natural draft over a week is required.

Of all the plants the writer has ever visited, the Donauwerke of the Bavarian Stickstoffwerke is one of the most interesting and instructive. Fig. 122 pictures the plant. In the rear are the old kilns of a capacity of about 30 to 35 tons a day. In the foreground is the modernized factory with a capacity of 133 tons of lime per day from each kiln, a truly remarkable increase accomplished mainly by raising the shafts and applying forced draft.

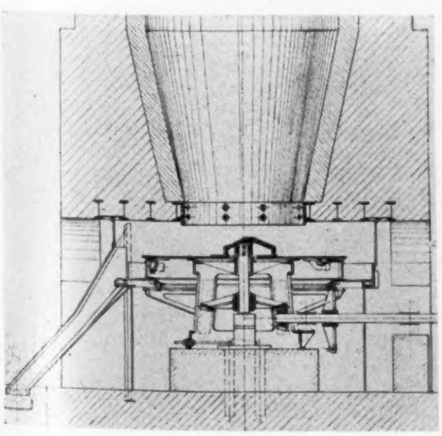


Fig. 121. Automatic draw

Some operating data on these kilns are given below:

KILN PERFORMANCES AT BAYERISCHE KALKSTICKSTOFF-DONAUWERKE

Old kiln capacity, each	33 tons
Normal new kiln capacity, each	133 tons
Maximum new kiln capacity	161 tons
Kiln shaft diameter	9.6 ft.
Kiln height	53 ft.
Average shaft area	72.4 sq. ft.
Kiln, total cubical content	3950 cu. ft.
Lime per cubic foot per day	67.8 lb.
Lime per square foot of shaft area, per day	3668 lb.
Air pressure of forced draft	16-20 in.
Loss on ignition—lime analysis	0.9%
Coke heat value per pound	10,800 B.t.u.
Coke layer	242 lb.
Stone layer	2640 lb.
Lime to coke ratio	5.5 : 1
Kiln efficiency	70%
Lime screenings	15-16%
Lime production per kiln between repairs	25,000-70,000 tons

The writer has operating records of direct-fired kilns that make just about one-tenth the lime the above kiln makes. Who would think it possible to make regularly almost 150 tons with an external shaft diameter of only 14 ft., when most of our 12-ton kilns have an external diameter hardly any less? In addition, the lime burned in this plant was quite crumbly and in the draw there were few large lumps. One would think this would make such high capacities impossible, and it would if it were not for the very high blast, at times as high as 20 in. of water.

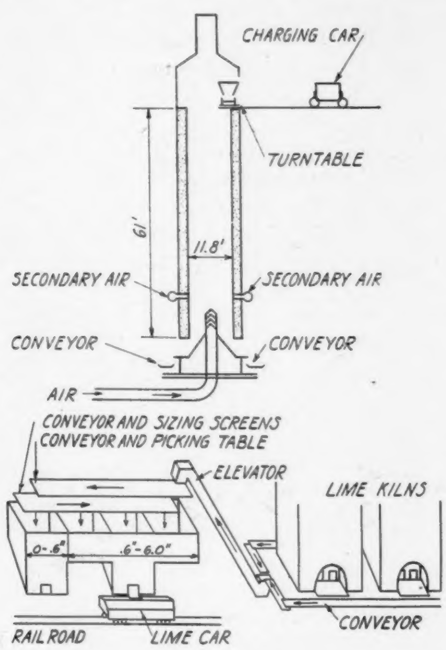


Fig. 123. Section of kiln and handling arrangements at Bavarian plant

Fig. 124. Director Ludowigs, Engineer Seeger and Managing Director Celto of the Bavarian works

Fig. 123 is a sketch of this plant. Limestone and coke are dumped direct into the kiln and distributed by hand with hoes. Lime is drawn by hand by two men drawing simultaneously into a conveyor, as was already shown in Fig. 112. The lime is elevated to a picking table on which it is in continual motion and from which it drops to a series of screens where the finer portions are segregated. The kilns have no automatic charging or drawing devices, but the plant is otherwise completely automatic.

Fig. 124 shows our old friend, Director Ludowigs, Engineer Seeger, and on the right the managing director of this particular plant, Councilor Ernest Cetto.

The performance of several different kilns is tabulated below. The tabulation embraces monstrously large kilns such as the Belgian at Hermales (with a shaft diameter of 26 ft. and having, considering its size, a very low capacity of 112 tons) and kilns with very much smaller shafts having, due to mechanical draft, very much higher capacities. In this tabulation one can compare the Fullwell kiln built in the eighties with the kilns that are being built today.

Probably next to the Donauwerke plant, the second in the tabulation, located near Ulm, Germany, is the most interesting. This

PERFORMANCE OF VARIOUS EUROPEAN MIXED-FEED KILNS

	Donau-werke	Ulm	Block in constr.	Ruders-dorf	Hermales (Belgium)	Fullwell (England)	Sobek (Czecho-Slovakia)
Kiln capacity, tons	133	143	220	80	112	56	110
Kiln shaft diam., ft	9.6	11.5	10.5	9	26	10x50	12.3
Kiln height, ft	53	78	98	43.5	53	40	62
Shaft area, sq. ft	72.4	104	87	64	540	480	119
Shaft space, cu. ft	3,840	8,100	8,500	2,800	28,300	19,200	7,350
Lime per cu. ft., space per day	69	35	49	57	8	5.8	30
Lime per sq. ft., shaft area per day	3,680	2,750	5,070	2,520	415	234	1,800
Average time through kiln, hr	19	29	25	21	163	221	43
Kiln efficiency, approx., per cent	69	83	78	70	......	......	80
Draft, pressure or suction	P18 in.	S13 in.		P12 in.	S–Mild	Natural	P
Kind of limestone	High cal. Crumbly	High calcium		Hydraulic Much small	High calcium	High calcium	High calcium

Fig. 126. High kiln at Ulm, Germany, with automatic charging and drawing, and induced draft

plant is owned by Herr Kurt Muhlen and was designed by the very able Engineer Eberhardt. Fig. 126 shows the plant as it is now in operation.

While at Donauwerke they charge and draw by hand and use forced draft, at this plant they charge and draw automatically and employ induced draft. That is, instead of the air being blown in under pressure, the gas is drawn out on top under a high suction. In these illustrations the high, large diameter structure is the kiln, around which the stairs are winding towards the top. Along the stairs every few feet there is an observation hole through which lime-burning temperatures at the various levels can be observed. The high, slender tube is the elevator casing in which a large bottom-opening charging bucket travels up and down. The two lower structures are for coke and stone storage.

Fig. 128. Charging bucket at Ulm kiln

The coke is hoisted through the vertical conveyor and dumped into the coke bin. The stone is hoisted by a peculiar side-dump skip, Fig. 127, and dumped into the stone bin. Underneath, the charging bucket is loaded with 2630 lb. of stone and 207 lb. of coke, pushed under the elevating tube and hoisted to the top. When this bucket reaches the top it is gripped by a lateral carrier that slides it sideways, automatically, as shown in Fig. 128, to a point above the kiln top. Both the bucket bottom and the tightly fitting kiln top, shown in the foreground of Fig. 128, slide away and the rock-coke charge drops into the kiln, past some deflecting baffles and a bell, which aid in properly distributing the two materials in the kiln shaft. In this same illustration, at the right, can be seen the substantial bolted steel kiln suction line, which when these photos were taken was 15½ in., but since has been enlarged to 25½ in.

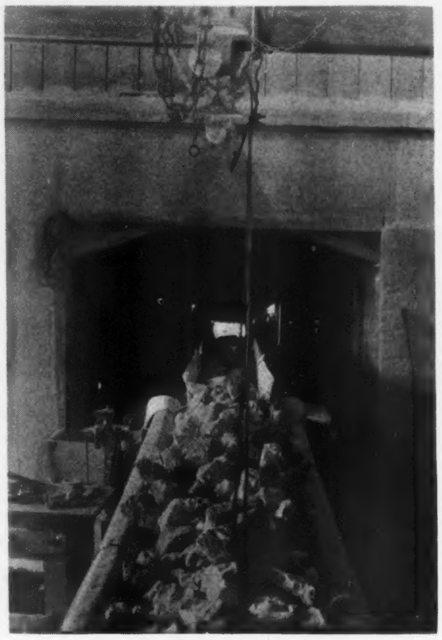


Fig. 129. Picking table over which lump lime passes

A top, with metal to metal contact, could hardly be considered if temperatures were high, as there would be danger of warping and developing leaks, which, due to the high suction of 13 in., would be fatal to the kiln capacities. However, temperatures are not high. They are only 175 deg. F., which is less than any encountered by the writer in all the lime plants he has visited. The low proportion of coke to stone feed, the low waste gas temperature, and the high CO_2 content (around 40%), all point to the high fuel efficiency of this plant.

The kiln has an internal diameter of 11½ ft. and an external diameter of 14¾ ft., which means that the walls are only a little over 1½ ft. thick and that the kiln is mostly all kiln and not mostly all masonry, as are so many of the large kilns.

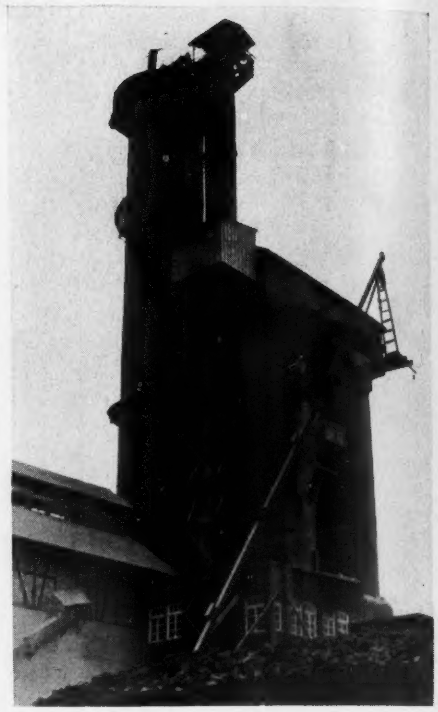


Fig. 127. Another view of Ulm kiln

The lime is drawn automatically at 4-min. intervals, and as it leaves the kiln it passes over shakers having fine holes to separate the small lime and the ash. As in Germany, the hydrate market is hardly developed at all. This fine material is either thrown away or sold for fertilizing purposes. The lump lime passes over a picking table, Fig. 129, on the way to the storage bins, and from the storage bins a railroad car (Fig. 130) holding about 18 tons is loaded in the short space of 3 minutes. As arranged, they could readily load 120 tons in half an hour. The loading car stands on a platform scale.

As the labor is only 19c an hour (piece time 40-50% more), one wonders if the extreme mechanization of this plant pays.

When the demand for lime is low they have an interesting way of operating part time. From 65 to 75 tons of lime are made if the suction is maintained only for 12

Fig. 130. Cars holding 18 tons of lime are loaded in 3 min.

Fig. 131. Small kiln which burns special limestone

hours and natural draft used the balance of the time. Under these conditions most of the lime is drawn and the kiln charged at night. During the daytime they draw only about 10 tons, merely to move the kiln charge to prevent sticking.

Although they use brick of only 30% alumina content the kiln has to be seldom repaired. When the writer visited the plant it had been in operation 20 months, and repairs were only of a minor nature. They said that it could have easily run continuously for the entire three years if the lime demand had justified it.

Herr Muhlen has another Eberhardt kiln, the predecessor to the large one, which should be of interest to us, as it has a shaft diameter of only about 3 ft. and produces approximately 10 tons of lime. This kiln, shown in Fig. 131, is the smallest shaft diameter lime kiln the writer has ever encountered. It is 34 ft. high. Operation here also is with the aid of induced draft. It would hardly pay to operate such a small kiln if it was not that special limestone, imported from Switzerland, is burned in it. The lime is used in tooth paste manufacture and was burned very light. The statement was also made that the limestone was not imported on account of whiteness, as their own lime was almost as white, but on account of the fact that although it was soft burned it did not have a great attraction for water.

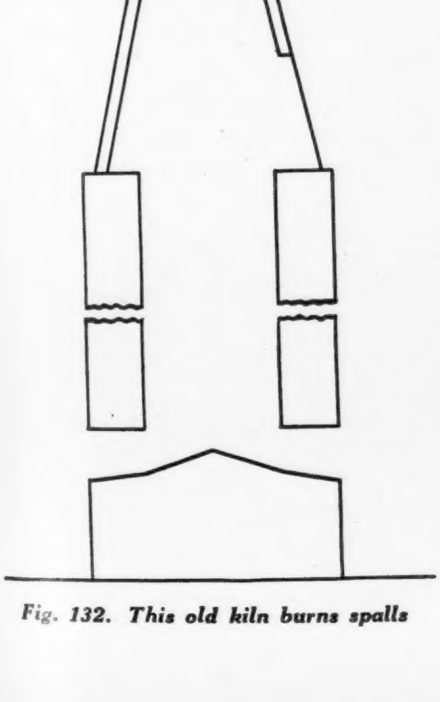


Fig. 132. This old kiln burns spalls

Mr. Muhlen operated also three ring kilns whose description would be out of place here, so description of his plant can close with his old fashioned, natural draft mixed-feed kiln of about the shape of Fig. 132. This kiln is of interest only in that stone spalls ranging in size from 1½ to 6 in. are burned with coke of 0.4 to 0.8 in. size. The spally stone pile shown in Fig. 117 is awaiting conversion to lime in these kilns. Capacity is low and efficiency not as high as that of the large kiln, but as almost all the stone is burned the operation is justified. Before terminating description of this particular plant we should give some attention to the fact that although the men get only 20 or 25 c. an hour, the company builds clean, attractive and comfortable houses for them, as shown in Fig. 133.

Fig. 133. Attractive houses are built by the company for its men

In conversation with Berthold Block, the writer was informed that he is building a kiln to have a shaft diameter of only 10.5 ft. and a capacity of 220 tons. This on the face of it looks ridiculous, but if we compare the Block kiln proportions in the third column of the tabulation with characteristics of Donauwerke and Ulm kilns and take into account the characteristics of the stone burned, we come to the conclusion that Herr Block can do just what he claims, provided the stone size and uniformity are favorable. At Ulm the stone is uniform but too large, giving the kiln too little heat absorbing surface. At Donauwerke the stone is small but too crumbly, blocking the kiln and requiring an impractically high blast if operated at the rate per square foot of kiln area Block intends to use. Block's kiln is much higher, almost 100 ft., and so has a high cubic content and per cubic foot of kiln content. It would not need to work as hard as the Donauwerke kilns, which are roughly only half as high. The whole is all a matter of surface, which means size of stone, height of gas column, and resistance to gas flow. Having ample surface and not too high resistance and plenty of time for heat exchange, determined by height, anything is possible.

Fig. 134. Sobek kiln near Vienna, Austria

The fourth kiln in the tabulation is the Sobek design, of which the patent rights in America are held by McGann Manufacturing Co. The writer did not see this particular kiln; however, he visited the plant at which Sobek did most of his experimenting. This plant is located near Vienna in Austria and is shown in Fig. 134. Fig. 135 shows Mr. Sobek flanked by two of his superintendents.

Sobek had, as his aim, the drawing of lime automatically without breaking up the lumps too greatly and accomplishing this with a low power consumption; also charging by as simple a system as possible. The

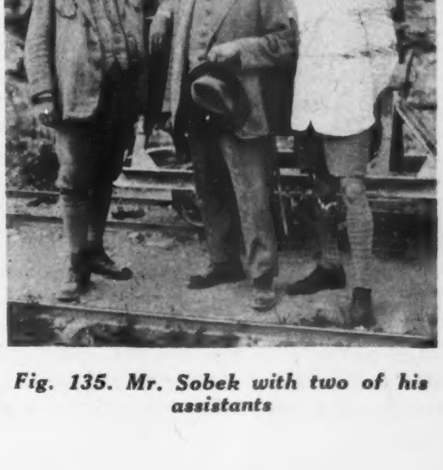


Fig. 135. Mr. Sobek with two of his assistants

performance characteristics of the Czecho-Slovakian kiln listed in the tabulation compare quite favorably. The capacity was not quite so high but no doubt neither were the blast pressures. A thermal analysis of the kiln as reported by unbiased persons indicated:

Temperature of lime drawn	104 deg. F.
Temperature of waste gas escaping	225 deg. F.
Temperature in the burning zone	1922 deg. F.
Pounds of coke to 100 lb. stone	7.38
Thermal efficiency	82%

Assuming that this is so and the writer has no reason to doubt its correctness, the performance could hardly be any better. The efficiency and coke consumption check exactly with those of our table in Fig. 108.

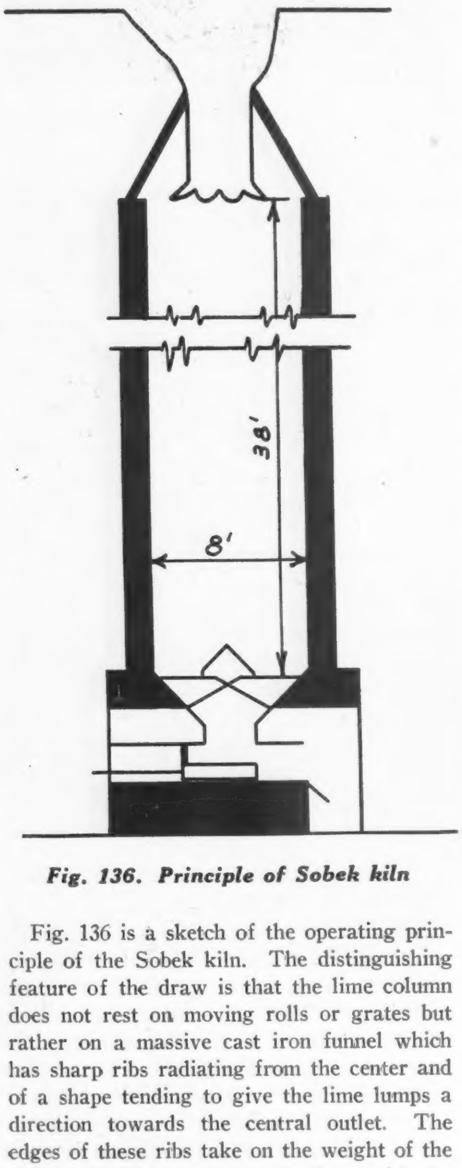


Fig. 136. Principle of Sobek kiln

Fig. 136 is a sketch of the operating principle of the Sobek kiln. The distinguishing feature of the draw is that the lime column does not rest on moving rolls or grates but rather on a massive cast iron funnel which has sharp ribs radiating from the center and of a shape tending to give the lime lumps a direction towards the central outlet. The edges of these ribs take on the weight of the charge while in between, the lime, with the pressure relieved, moves to the outlet.

The Sobek charging system in evolution is shown in A, B and C of Fig. 137. The idea requires that the kiln be always full. The shape of the funnel is such that the stone and coke assume uniform layers and as the kiln charge lowers there is a continual replenishment from the funnel. Fig.

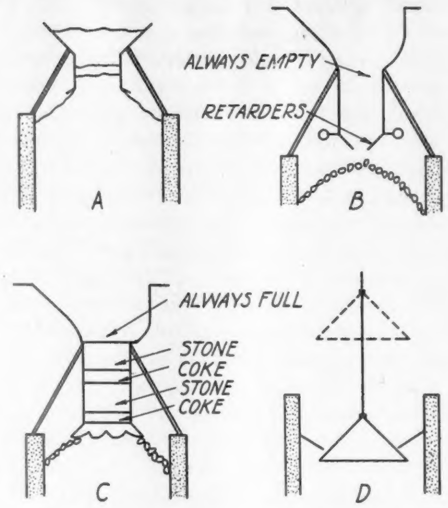


Fig. 137. Evolution of Sobek charging system

138 shows the bottom of the funnel in the kiln. As the stone enters without a fall the large pieces are less likely to roll to the walls where they are not desired. A more uniform distribution is the result even though this distribution is not exactly that desired of large pieces in the center and small ones without coke at the wall.

Getting the spalls to the walls is really far from simple and all kinds of schemes have been tried. At D of Fig. 137 is a diagrammatic view of a system used to some extent at Donauwerke. They have a huge bell that can be lowered on top of the stone mass and on to this bell spalls are dumped. On raising the bell out of the way to the dotted

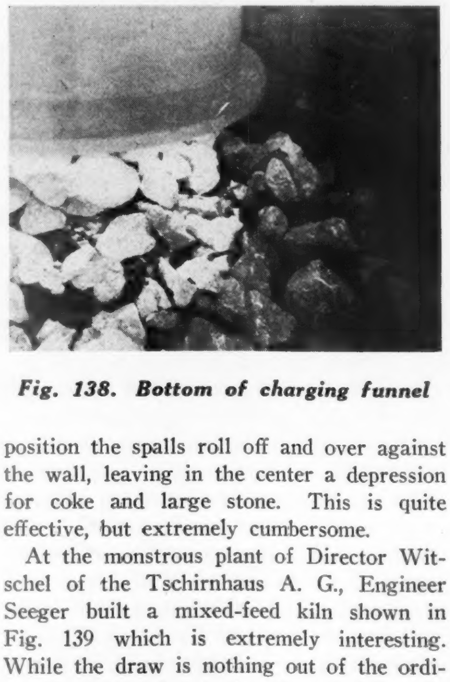


Fig. 138. Bottom of charging funnel

position the spalls roll off and over against the wall, leaving in the center a depression for coke and large stone. This is quite effective, but extremely cumbersome.

At the monstrous plant of Director Witschel of the Tschirnhaus A. G., Engineer Seeger built a mixed-feed kiln shown in Fig. 139 which is extremely interesting. While the draw is nothing out of the ordinary, the charging device aims to segregate spalls to the outside with coke and large stone to the center. This system, shown in Fig. 140, was initially developed by Dipl. Ing. Knoringer of Wulfrath. There are two bells, one within the other. When stone is charged the whole is lowered in unison, the charge falls against spaced bars, the small rock passing through, while the large falls back into the kiln center. When coke is charged, only the center bell is raised and the coke flows through the much smaller opening against the deflector to be distributed in the desired circle around the center but still entirely away from the walls.

Herr Seeger stated that with this charging apparatus he used rock very irregular in size and the large 12 in. lumps were completely burned while the small sizes were not overburned, even though he used cheap coke very small in size. With such a charg-

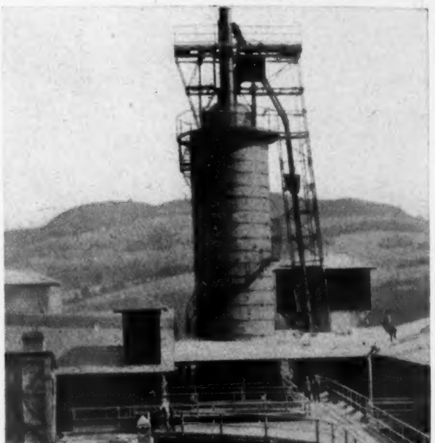


Fig. 139. Kiln with charging device for segregating spalls to outside

ing system perfected, steam shovels could be used in the quarry and most anything loaded into the kiln, thus greatly reducing hand labor.

At this same plant stands the miniature kiln of Fig. 141 used by Director Witschel for experimental burning of limestone, which is interesting only for its smallness in contrast to the heights of Block and Eberhardt kilns.

Practically all mixed-feed kilns have round shafts. To find anything else anywhere is unusual. One of these exceptions is the plant of Director Rinker at Blankenburg in the German Harz mountains. This kiln, Fig. 142, was initially built for gas which

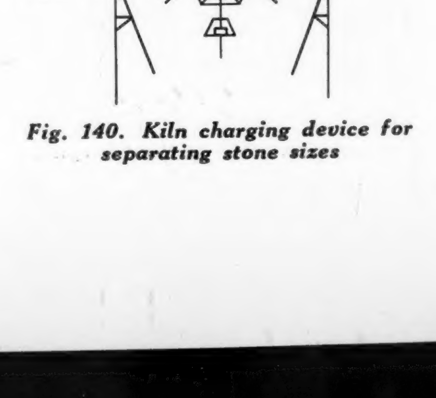


Fig. 140. Kiln charging device for separating stone sizes

Fig. 141. Small experimental kiln

is the reason for shafts other than round, and also explains the double shaft construction. Herr Seeger devoted much time towards improving the operation of this kiln. He now has the satisfaction of having increased the capacity from 55 to 125 tons of lime while simultaneously reducing fuel consumption. The last I heard of this kiln it produced over 50,000 tons of lime without once being off for repairs.

Fig. 143 gives an idea of the type of this kiln. It is open above with forced draft below and neither the charging nor the drawing of lime is mechanical. Many special tricks have to be practiced to assure proper admixture of coke on account of the cross-sectional shape of the shaft. There is no side dumping of rock or coke, as that causes the larger material to congregate on the opposite side. Both the stone and coke are

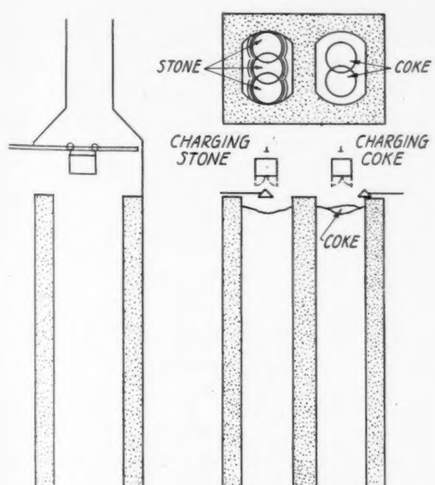


Fig. 143. Cross-sections of double-shaft oval kiln

dumped from bottom opening monorail tram buckets straight down into the shaft. The dumping is in three positions for stone and two for coke, as shown at B of Fig. 143 and also in Fig. 144, which shows the top of the charge in the kiln, with the edges of shaft free of coke and the foreground portion still uncharged.

Oblong shafts such as the above for mixed-feed purposes are not just the thing. The above kiln was only described because someone over here may want to adapt existing kilns to this internal firing. It can be done, but it is best to start right, which in this case means a round straight shaft.

The writer has data on many more mixed-feed kiln plants but will not go into the matter further here except to describe one more plant located in England in which coal is used instead of coke.

Much of the lime in England is made in the Buxton region in which there are 15 lime plants using the Hoffman or the ring kilns, Spencer kilns and the conventional type of mixed-feed kiln. Peculiarly there are no gas kilns. The Buxton Co. tried them but

Fig. 142. Double-shaft kiln of oval section

evidently those they tried were not very good, as the trials were not a success. One reason given for the preference for mixed-feed kilns was that they need no night attention, while a gas producer needs continual attention. As coal in this region costs only 13 shillings, while coke costs 21 shillings, coal is used in the mixed-feed kilns, even though most of the heat in the volatile matter is wasted and the kilns smoke badly.

Mr. Frith, whose plant was visited, stated that with coke they get somewhat greater output and somewhat better lime, but occasionally they use half coke and half coal. This is also done at times in Germany when the coal is fed in the zones to which the larger rock gravitates and up through which most of the excess air comes, thus aiding in burning some of the volatile matter that would otherwise all be wasted.

Frith kilns, one of which is shown in Fig. 145, are drawn and charged only during the eight-hour day shifts. Firing is continuous and the top after cha ging is naturally cool,

Fig. 144. Top of charge in kiln

but toward morning becomes very hot, with fire breaking through the stone. Under these firing conditions, combined with the fact that coal rather than coke is used, the fuel efficiency is naturally not very high, a ratio somewhere in the neighborhood of 4 to 1, but this poor efficiency is compensated by the cheap fuel used and by the saving of all except the labor of one shift.

A Frith kiln of their own design is shown in Fig. 145. It is 60 ft. high, 15 ft. in diameter and produces about 37 tons of lime per day. Limestone is charged in an unusual way which will be described more fully in another section of this series dealing with limestone and lime handling methods. It is accomplished by a specially designed car which travels between the fixed skip and the kilns, all controlled entirely from below. The lime is drawn by means of drum feeders.

Irving Warner, who visited this plant, stated that the lime quality was excellent, the best he has seen obtained anywhere from mixed-feed kilns and with very little core, and that overburning consisted principally of surface discoloration, the inside of the broken lumps being very mellow.

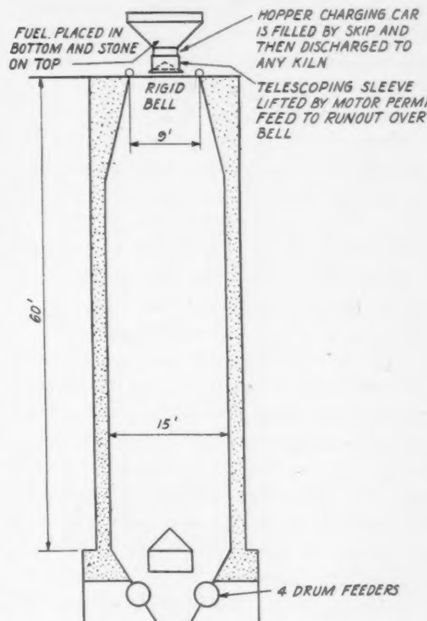


Fig. 145. English mixed feed kiln

Conditions in the lime industry in Great Britain are peculiar. There is no solidarity among the producers. They all function independently in constant fear of the mushroom producers that may spring up here or there on the developed good highway systems within short shipping distances of the consumers. There also is continual scrapping between the producers of the many different grades of lime, which is natural, as they have lime of the hydraulic type as well as lime ranging from high calcium to high magnesium. Then, those who are producing lump lime claim an advantage over the others. Lime from gas kilns is fought by some manufacturers and does not sell so well and as naturally cheap production means little, if there is no sale, peculiar methods, not the best from the engineer's viewpoint, become permissible.

This dissertation on mixed-feed kilns could be continued, for there is much to be said and many different kilns to describe. But there are other types to be described in which the American reader may be more interested, such as the natural gas and producer gas-fired types, the rotary kilns, and, in addition, there are many other items in a lime plant that should receive some attention, ranging from thermodynamics to material handling.

To be continued)

Shale in Aggregates

"SHALE IN AGGREGATES," by E. F. Bean, Wisconsin State Geologist, from which what follows has been abstracted, was read at the eleventh annual meeting of the Highway Research Board, National Research Council. It is the result of a study undertaken because practically all state highway departments reject concrete aggregates which contain more than a small percentage of shale.

Clays, from which shales come, are the products of the weathering of rock. If the particles are less than 1/256 mm. the product is classified as clay; if coarser it is called silt. Shale is clay consolidated to a fine grained rock by natural processes. The hardening process may be reversed with some shales by soaking them in water, especially if the shales have been air dried. Some shales will slake in as little as three minutes.

The word shale is used structurally to describe other bedded rocks, as sandstones and limestones. Since the original sediment was not pure clay in all cases, there are all gradations with increasing sand content between shale and argillaceous sandstone. With calcareous material, shale grades in a similar manner into argillaceous limestone. Shales are soft, cut readily and are brittle. Geologically, they are important as they are about 80% of the sedimentary rocks. The specific gravity averages 2.71 (Leith and Mead). The average porosity of clay is 27% and of shale 13%. The mineral average composition (Leith and Mead) is: Quartz, 31.19%; kaolin, 10.00%; white mica, 18.40%; chlorite, 6.40%; limonite, 4.75%; dolomite, 7.90%; gypsum, 1.17%; orthoclase, 12.05%; albite, 5.55%; rutile, 0.66%; apatite, 0.40%; carbon, 0.81%.

Shale becomes slate through pressure, contact metamorphism, and the effects of high temperature and pressure. Slates change over to phyllites (leaf stones) which split into very thin sheets. Still further change produces mica schist, where much mica is present. There is thus a continuous series of rocks derived from clay by progressive metamorphism (dehydration and crystallization).

As the clay from which these rocks were formed was produced by weathering, they are chemically stable, but the effect of weather is to break them down mechanically. Resistance to weathering is determined by the degree of metamorphism. Shale being the youngest rock weathers most rapidly. Since shale is so fine grained, the pore spaces are subcapillary, the water is confined and the destructive effect of freezing is greater than in a porous sandstone. But slate resists weather so well that it has long been considered most durable.

Shale does not outcrop much as it weathers so rapidly. But in areas underlain by it, it is a common constituent of gravels. As shale abrades readily, the percentage in stream gravels decreases rapidly upon transportation by the stream away from the ledge. Examination of weathered exposures of gravel may give important data regarding shale. In weathered portions a shale pebble may be represented by small chips or a mass of clay. In recently exposed portions of the deposit the shale pebbles may appear to be quite hard and sound.

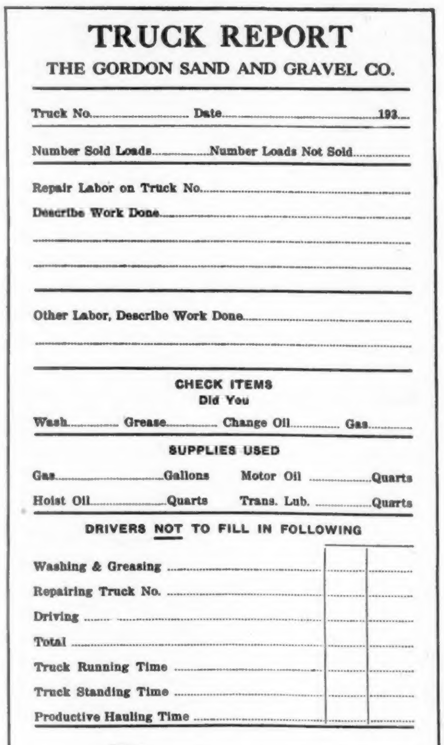
A simple test for determining whether a specimen is shale or slate is to grind it to a fine powder and mix it with water. Shale so treated becomes a soft, plastic mass while slate does not.

There is some possibility of removing shale from gravel in the plant, but methods depending on specific gravity are difficult to apply. The average specific gravities of ordinary Wisconsin rocks are: Granite, 2.655; dolomite, 2.808; sandstone, 2.631. The specific gravity of nine samples of shale was, maximum, 2.70; minimum, 2.50; average, 2.56. For 18 Iowa shales the maximum was 2.64; the minimum, 2.25, and the average, 2.45.

A system of grinding the friable particles of shale might be effective if the cost was not too great.

If a limestone quarry is under consideration the weathered ledge should be carefully examined for shale. Thin ledges of limestone are usually separated by thin ledges of shale. Even massive beds may decrepitate on weathering because of paper thin shale partings. Loughlin mentions failure of a Pennsylvania limestone due to clay and organic matter in irregular spots. The clay mineral was beidelite. A chemical analysis may indicate the clay content of a stone. Service history of a quarried stone gives valuable information, but it must be remembered that care has usually been used in its selection.

Slates and schists are sound and weather resistant but they are considered objectionable because they break into slabby fragments.



TRUCK REPORT

THE GORDON SAND AND GRAVEL CO.

Truck No. .... Date .... 193..

Number Sold Loads .... Number Loads Not Sold ....

Repair Labor on Truck No. ....

Describe Work Done ....

Other Labor, Describe Work Done ....

CHECK ITEMS
Did You

Wash .... Grease .... Change Oil .... Gas ....

SUPPLIES USED

Gas .... Gallons Motor Oil .... Quarts

Hoist Oil .... Quarts Trans. Lub. .... Quarts

DRIVERS NOT TO FILL IN FOLLOWING

Washing & Greasing ....

Repairing Truck No. ....

Driving ....

Total ....

Truck Running Time ....

Truck Standing Time ....

Productive Hauling Time ....

Driver ....

Form for truck drivers to keep track of costs

Bibliography on Standardization

A BIBLIOGRAPHY comprising references to the general literature on standardization has been issued by the Bureau of Standards as Miscellaneous Publication 136. In the review citations to the more specialized literature on standardization of specific commodities have been omitted.

Daily Truck Report Proves Economical

UNREGULATED OPERATION of delivery trucks may prove to be an expensive problem and to avoid all unnecessary expense the Gordon Sand and Gravel Co., Denver, Colo., is having all truck drivers fill out the report, illustrated herewith. Reports are made daily. The closer supervision which has been given to this phase of the business has resulted in appreciable savings in delivery costs.

Will Small Business Survive?

By David A. Weir

Assistant Executive Manager, National Association of Credit Men

ONE of the developments within the last two years has been the growth in evidence that "little business" is not so little after all. Many comparatively small, well managed businesses have been passing through the period of trial much more acceptably than have some of the larger and more unwieldy enterprises. This has been due for the most part to the greater degree of flexibility and ability to adapt the smaller business to changing conditions.

The larger concern with a more pretentious system of financing is handicapped during times of stress. A large concern with fixed obligations to be met finds it difficult to make the necessary adjustments. This applies especially to those companies having large outstanding bond obligations. While there is no legal obligation for the payment of dividends on stocks, many large companies have also felt that they should make every effort to maintain dividend payments. This also has proved a source of trial. Where the plant and equipment are excessive the problem is still further complicated.

It is worthy of note in this connection that one more fallacy of the so-called "new economics" of three years ago has also been exploded. One of the doctrines preached three years ago by some economists and business leaders was that it makes little difference whether banks can or will furnish working capital as long as this capital can be procured through the sale of stock or the issuance of bonds. In this line of reasoning two things were ignored.

First—during the boom period many small businesses had difficulty in securing working capital because they were not in a position to sell either stocks or bonds at a time when those who had money to invest were looking for an over-night return.

Second—the sale of stocks or bonds is not the proper way in which to secure working capital where such funds are needed only for short periods of time or at irregular intervals. It is fortunate for many small business enterprises that they were unable to finance their businesses through the sale of stocks and bonds. The defect in excessive use of that type of financing is now being shown by the unwieldiness of the financial structure of many large enterprises where large amounts of stocks or bonds were issued during the "boom" period.

The smaller business organizations with a more compact financial structure and without excessive plant and equipment have been able to make the necessary adjustments more readily. As a result many of these have been able to at least break even and a not inconsiderable number have continued to make a small profit.

Special emphasis should be placed upon the statement that this condition exists in many well managed small businesses. The evidence of such management is now apparent and it is further apparent that one of the real indications of efficient management is the existence of sufficient foresight during prosperous periods to keep financial structures in such shape that adaptation to less prosperous conditions can be made.

Many good little businesses have been ruined by big business ideas. During the "boom" period in business, there were many small but prosperous establishments with good markets and good sales at a profit, but which were ruined because of executives who felt that million dollar concerns should be operated upon the same basis as ten million dollar ones. In one case which I had an opportunity to observe closely a few years ago, the executive of a $300,000 manufacturing company maintained useless offices in six large cities merely because a fifteen million dollar competitor had offices in those cities. As a direct result of this and other similar "big business" policies, the smaller company which really had a superior product, was forced into bankruptcy. While this case was an extreme one, it is indicative of a tendency disastrous to many.

The present is a time for the well managed small business to establish itself. Following a return of more normal business conditions competition will probably be keener than ever before. It is likely that many small enterprises will not be able to survive the stress of that greater competition. On the other hand, many of these smaller units having passed through the time of trial and having kept their houses in order, will have a better chance to survive than ever before. Just as it is true that in the parlance of the prize ring a "good big man is better than a good little man," so it is true that a good big business is better than a good little one. But we are learning that the good little business may win out over the big business which has become bloated with high financing. Keeping fit for the test of hard competition is just as necessary in the game of business as in any athletic endeavor.

"Survival of the Fittest"

One of the half-truths which persists in regard to business is that all business is a survival of the fittest. Even though it is recognized that there are thousands engaged in commercial activities who do not belong there, the point is made over and over again that these people will be removed ultimately by a process of elimination. As this idea applies to retail business especially, it can not at best be more than half true.

It is true, of course, that a time of business trial means that thousands of those who are not fitted either from the viewpoint of finance or of ability to carry on, are eliminated. The other half of the picture has to do, however, with replacement. The point often ignored is that in a great percentage of cases those who may be eliminated by the stress of competition are replaced by others who are equally incompetent.

This is a condition which is thoroughly unsound both from the viewpoint of business and the general welfare. It is no more ethical to encourage incompetents to opererate business than it is to encourage them to operate aeroplanes carrying passengers. If a plane crashes, it is bad for the pilot, for the passengers and for the aeroplane industry itself, as well as for any innocent bystanders who may be underneath the plane when it falls.

When incompetents are not only permitted but urged to remain in business in order that sales may be greater, the ultimate result inevitably will be disastrous. Here, too, the one conducting the business, the creditors who ride along with him and the innocent bystanders who are injured in the crash, will all suffer. Our billion dollar annual loss in bankruptcies is only a start, as not nearly all of our losses show up in bankruptcy statistics. Many of these costs have to be paid by the ultimate consumer in some way or other, and the fact that this waste exists is one of the big reasons why depressions strike us, with the consequent closing of factories and the release of workers from employment.

Suggestions are made from time to time that there should be some kind of license law limiting those who engage in business activities. Such plans do not provide a practical solution for the difficulty, at least at the present time. Much control of this evil can be exercised by credit executives themselves with the support of other business executives. If the greed for sales overcomes a sound credit policy or if the credit policy itself is not motivated by a proper understanding and by sound principles, the evil of incompetence in business will grow rather than decrease. The sources of credit information are abundant. This information is no longer confined to statements made by the purchaser and one or two of his creditors whose names may have been given as references by the debtor. In addition to various other sources of credit information it is possible to procure, as thousands of credit managers are daily procuring, compiled reports showing the outstanding indebtedness and the actual paying habits of the debtor to creditors in all parts of the United States. With such an abundance of information as is now available, and with the breadth of view which places net profits above gross sales, it is possible to make business, actually as well as theoretically, a survival of the fittest.

Investigations of the Setting of Plaster of Paris

THE RESULTS of an investigation of the setting of plaster of Paris by Charles S. Gibson and Rowland N. Johnson were recently published in the *Journal of the Society of Chemical Industry.* The investigation was carried out under the auspices of the Dental Board of the United Kingdom, and while the work was carried out evidently with dental plasters in mind, there is considerable in the article of interest to all gypsum producers.

As the linear expansion of accelerated and retarded plaster is of secondary interest to the plaster manufacturer, the results obtained on this phase of the investigation are not covered in this abstract. The article as published, however, gives a large amount of data, including graphs showing the effect of the various salts used on the expansion of gypsum plaster.

A study was made in the changes in rate of setting and linear expansion produced when gypsum stucco was mixed with solutions of numerous salts at varying concentrations. The following classes of salts were investigated: The normal sulphates of uni-, bi- and tri-valent metals; the normal potassium salts of inorganic and organic acids; normal sodium chloride, nitrate, sulphate, carbonate and tartrate, and sodium hydroxide; calcium chloride, nitrate and sulphate; borax (a powerful retarder); and accelerators plus borax.

Tests for Setting Time

In the test for setting time 80 g. of plaster of Paris were added to 48 c.c. of solution and the mixture stirred for one minute unless quick sets developed when the mixing time was reduced to ¾ or ½ min. The temperature was maintained at 20 deg. C. The Vicat needle was used to determine the final set and while an arbitrary end point was used the series of tests are comparative.

Effect on Rate of Setting

(*a*) *Sulphates.* With the exception of the ferric sulphate all of the sulphates examined were accelerators and the accelerating power increased with the concentration of the solution, though not proportionately. Ferric sulphate acted as a retarder in all concentrations up to 2.0 *N*.

Sodium sulphate up to 2 *N* acted as an accelerator and thereafter as a retarder. Comparing solutions of equivalent concentrations the accelerating power, generally speaking, decreased as the valency of the cation increased. The following orders of decreasing accelerating power was observed:

ORDER OF DECREASING ACCELERATING POWER

0·125*N*	0·25*N*	0·5*N*	*N*	2*N*
K·	K·	K·	NH₄·	NH₄·
Rb·	Rb·	Rb·	K·	Li·
Cs·	Cs·	Cs·	Cd··	Cd··
NH₄·	NH₄·	NH₄·	Li·	H·
Na·	Cd··	Na·	Cu·	Cu··
Cd··	Na·	Cd··	H·	Zn··
Ni··	Li·	Li·	Zn··	Mn··
Cu··	Mg··	Zn··	Mg··	Mg··
Mg··	Zn··	Mn··	Mn··	Fe··
Zn··	Ni··	Ni··	Ni··	Ni··
Cr···	Cu··	Cu··	Na·	Cr···
Mn··	Mn··	Fe··	Cr···	Al···
Fe··	H·	Mg··	Fe··	Na·
H·	Fe··	Cr···	Al···	Fe···
Al···	Cr···	H·	Fe···	
Li·	Al···	Al···		
Fe···	Fe···	Fe···		

Comparing equivalent solutions of the univalent sulphates alone at concentrations up to 0.5 *N* the accelerating power increased in the following order: H·, Li·, Na·, NH₄·, Rb·, Cs· and K·. Rubidium and cæsium sulphates appeared to be slightly weaker accelerators than potassium sulphate.

The bivalent sulphates, with the exception of cadmium sulphate, have almost identical accelerating powers at all concentrations. Cadmium suphate was more active than the rest, but about equal to sodium sulphate when the later is used in low concentrations.

Of the trivalent sulphates, chromic sulphate was the most powerful accelerator and slightly less active than the bivalent sulphates.

Potassium salts. In this group all were powerful accelerators with the exception of the carbonate and hydroxide and compare, for equivalent concentrations, with the sulphates. At and above 2 *N* concentrations of potassium oxalate and tartrate gave an almost instantaneous set. The effect of progressive increase in concentration is in general the same as in the case of the alkali sulphates, all except the oxalate and tartrate showing a definite decrease in accelerating power at higher concentrations.

The data obtained indicate that potassium carbonate is a mild accelerator at all concentrations between about 0.125 *N* and 3 *N*, with the exception of a small range at about *N*, at which it is practically neutral, and a mild retarder below 0.125 *N* and above 3 *N*. Its greatest accelerating power is exerted at about 1.5 *N*.

Potassium oxalate and tartrate also behave as mild retarders at very low concentrations, and the same is true for sodium tartrate and Rochelle salt (sodium potassium tartrate).

Retarders—Borax Solutions Important Factors

Potassium acetate, succinate, malate and citrate are powerful retarders at most concentrations. Potassium acetate shows increasing retardation with increased concentrations up to 2 *N*, at which the setting was delayed for 24 hours. The succinate, malate, and citrate, on the other hand, give setting curves with definite maxima. The maximum retardation was as follows: succinate, 1½ hr. at *N* concentration; malate, 4 hr. at 0.5 *N*; citrate, 3¾ hr. at 0.1 *N*. The setting time curve shows that the relative retarding powers of the four salts differ considerably according to concentration at which they are compared.

Sodium salts. Sodium sulphate, chloride, nitrate, tartrate, and hydroxide are all accelerators up to 1.5 *N* and 2 *N* concentrations, but not quite so powerful as the corresponding potassium compounds. At higher concentrations they are all retarders.

Between 0.25 *N* and *N* concentrations the accelerating powers of these compounds show only small differences as in the case of the potassium compounds. Sodium tartrate and Rochelle salt are approximately equal in accelerating power up to 0.25 *N* or 0.5 *N* concentrations, but above this the sodium tartrate is the more powerful.

The set-concentration curve for sodium carbonate shows an initial rise, similar to that in the potassium carbonate curve, but whereas the later is an accelerator at most concentrations, sodium carbonate is a retarder. Up to 0.25 *N* its retarding effect is small; between 0.25 *N* and 0.5 *N* it is almost neutral and above this its retarding

EFFECT OF POTASSIUM AND BORAX ON SETTING TIME

Concentration of potassium tartrate		% $Na_2B_4O_7$					
Normality	% $K_2C_4H_4O_6$	Nil	0.1	0.2	0.3	0.4	0.5
Nil		13 min.	14 min.	14 min.	15 min.	19 min.	25 min.
0.008	0.09	14½ min.	23 min.	24 min.	26 min.	29 min.	38 min.
0.016	0.17	17¼ min.	25 min.	35 min.	42 min.	51 min.	62 min.
0.031	0.35	13¼ min.	$\boxed{\text{80 min.}}$	2 hr.	2 hr.	1¾ hr.	2½ hr.
0.062	0.70	10 min.	29¾ min.	$\boxed{\text{6½ hr.}}$	>9 hr.	>9 hr.	>9 hr.
0.125	1.41	6½ min.	17 min.	6¼ hr.	$\boxed{\text{17 hr.}}$	$\boxed{\text{40 hr.}}$	48 hr.
0.25	2.83	3¾ min.	13¾ min.	65 min.	10 hr.	22 hr.	....
0.5	5.65	2½ min.	15 min.	61 min.	3¼ hr.	9¾ hr.	....
1.0	11.3	3 min.	6 min.	20¾ min.	46 min.	2 hr.	2¾ hr.
2.0	22.6	Cannot mix	Cannot mix	Cannot mix	1¼ min.	5¾ min.	5¼ min.

power increases progressively. A 2 *N* solution delayed the setting for 1 hr. and a 3 *N* solution for 1½ hr.

Calcium salts. At concentrations up to 2 *N* the effect of calcium chloride and nitrate on the setting time was negligible, but at higher concentrations they have a slightly retarding action. It is significant that a saturated solution of calcium sulphate (0.2% $CaSO_4$) has no appreciable effect on the setting time.

Borax. All aqueous solutions of borax retarded the setting of plaster, and the retarding effect increases with the concentration. Solutions containing up to 0.5% $Na_2B_4O_7$ exert only a slight retarding action, but as the concentration is increased the retardation is very pronounced. A solution containing 2% of $Na_2B_4O_7$ delayed the set for more than 8 hr. in every case. Borax is therefore a more powerful retarder than sodium carbonate, which only commences to exert an appreciable retarding action at a concentration of 5% Na_2CO_3, but less powerful than potassium citrate and malate when compared either at equal percentage concentrations or equinormal concentrations.

Possible to Get Any Desired Set with Low Expansion

Combined effect of accelerators and retarders. It was shown that the most effective agents for accelerating the set and reducing the expansion of plaster were potassium salts. The concentration of the salt solution necessary, however, to produce the maximum reduction in expansion will also exert such a strong accelerating action that the plaster will stiffen during mixing, or set so rapidly that it cannot be put to any practical use. By introducing a small quantity of borax into the solution, the set of the plaster can be delayed some minutes without any appreciable increase in expansion. It is therefore possible, by adjusting the proportions of potassium sulphate and borax, to make up a solution which will give any desired set and a very low expansion. A further important practical feature is that prolonged stirring has little effect on the setting time or the expansion of plaster when mixed with an anti-expansion solution of this type.

In the case of solutions containing an alkali tartrate and borax the retardation produced is, in most cases, greater than that which would be produced by the borax alone, and furthermore, a very small amount of borax is sufficient to produce a very pronounced retardation, or even to inhibit the setting altogether.

The effects of varying proportions of potassium tartrate and borax on the setting time are shown in the accompanying table.

It will be seen that each has a pronounced maximum setting time corresponding with a strong anomalous retardation. For any fixed concentration of potassium tartrate, the anomaly becomes more pronounced as the borax concentration is increased. On the other hand, if the borax concentration is fixed, there is one intermediate concentration of potassium tartrate which produces the maximum retardation. At high tartrate concentrations the setting time again becomes normal, irrespective of the amount of borax added.

Sodium tartrate and Rochelle salt behave in a similar way in presence of borax. When equivalent solutions of the three tartrates were compared, the results indicated that, for a given percentage of borax, the mixed salt produces the greatest and the sodium salt the least retardation.

Potassium acetate, citrate, succinate, and malate, which alone act as powerful retarders, also produce anomalous retardations in presence of borax, but the effects are not so pronounced as with tartrates and borax. As has been noted before, all these strongly retarding solutions produce very low expansions.

Potassium oxalate, which alone acts as a powerful accelerator, comparable with the sulphate or tartrate, behaves quite normally in the presence of borax, that is, like the sulphate.

The same anomalous retardation of the setting was observed on using solutions of Rochelle salt containing sodium or potassium hydroxide or carbonate. In this respect, the hydroxides are much more effective than the carbonates, but not quite so effective as borax.

Mineral Fillers for Asphalt Paving

AT THE MEETING of Asphalt Paving Technologists, held in Detroit, Mich., in January, the committee on present practice reported on substances used for mineral filler. Two of the three tables which make up the report follow. They give the number of times each filler was mentioned in 41 specifications analyzed, which is some measure of its popularity with highway engineers, and the requirements for the grading of fillers demanded by different cities.

TABLE 1. MINERAL FILLERS SPECIFIED FOR SHEET ASPHALT PAVEMENTS

(The number after each material is the number of times it is specified in the 41 specifications analyzed.)

Portland cement	32
Natural cement	1
Limestone dust	38
Levigated limestone	1
Limestone dust, 80% calcium carbonate	1
Dolomite dust	4
Slate dust	11
Silica dust	4
Silica dust, 95% pure silica	1
Shale	1
Diatomaceous earth	1
Flake dust	1
Ground oyster shells	1
Stone dust	8
Rock dust	1
Hard durable rock	1
Levigated stone	1
Inorganic dust	1
Approved inorganic dust, farinaceous consistency	1
Impalpable powder	1
Approved mineral dust	3
Approved mineral filler	1
Approved material	1
Total materials	23

TABLE 2. MINERAL FILLERS FOR SHEET ASPHALT PAVEMENTS

(The materials included in each specification are indicated by asterisks)

	Materials							Grading					
								Minimum passing					
Specifications	Limestone dust	Portland cement	Slate dust	Stone dust	Silica dust	Dolomite dust	Other materials	30	40	50	80	100	200
Asphalt Assn.	*	*	*	......	......	......	*	100	......	......	......	......	75
Am. Soc. Munic. Engrs.	*	......	......	......	......	......	......	100	......	......	......	85	65
Chicago Paving Lab.	*	*	*	......	*	......	......	......	......	......	......	......	70
Western Laboratories	*	*	......	......	......	......	......	......	100	......	......	......	75
New Jersey	*	......	*	......	......	*	*	......	......	......	......	95	85
Pennsylvania	*	......	......	*	......	......	......	......	......	100	......	......	67
Michigan	*	*	......	......	......	*	*	100	......	......	......	......	75
Hartford, Conn.	*	*	*	......	......	......	......	100	......	......	......	......	65
Providence, R. I.	*	*	......	*	......	......	......	100	......	......	......	......	66
Manhattan Boro, N.Y.	......	*	......	......	......	......	*	100	......	......	......	85	70–90
Rochester, N. Y.	*	*	......	......	......	......	*	100	......	......	95	......	75
Buffalo, N. Y.	*	......	......	......	......	......	*	100	......	......	......	85	65
District of Columbia	*	*	......	......	......	*	......	100	......	......	......	......	65
Richmond, Va.	*	*	*	......	......	......	......	100	......	......	......	......	65
Knoxville, Tenn.	*	*	*	......	......	......	......	......	100	......	......	......	75
Miami, Fla.	*	*	......	......	......	......	*	100	......	......	......	......	65
Columbus, Ohio	*	*	......	......	*	......	......	100	......	......	......	......	80
Indianapolis, Ind.	*	*	*	......	......	......	*	100	......	......	......	85	66
Detroit, Mich.	*	*	......	......	......	......	*	100	......	......	......	......	75
Chicago, Ill.	*	*	......	......	......	......	*	100	......	......	......	......	80
Milwaukee, Wis.	......	......	......	*	......	......	......	......	......	......	......	......	85
St. Paul, Minn.	*	......	......	......	......	*	......	100	......	......	......	......	75
Lincoln, Nebr.	*	*	......	......	......	......	......	......	100	......	......	......	75
Omaha, Nebr.	......	*	......	*	......	......	......	"Passing 200-mesh"					
St. Louis, Mo.	*	*	......	......	......	......	*	......	......	......	100	......	75
St. Joseph, Mo.	*	......	......	*	......	......	......	......	......	......	100	......	80
Hutchinson, Kan.	*	*	......	......	......	......	......	100	......	......	......	......	75
Topeka, Kan.	*	*	......	......	......	......	*	100	......	......	......	85	65
Wichita, Kan.	*	*	......	......	......	......	......	100	......	......	......	85	65
Birmingham, Ala.	*	*	*	......	......	......	......	100	......	......	......	85	65
Monroe, La.	*	*	......	......	......	......	......	100	......	......	......	......	85
New Orleans, La.	*	*	*	......	......	......	*	100	......	......	......	85	65
Shreveport, La.	*	*	*	......	......	......	......	100	......	......	......	......	65
Tulsa, Okla.	*	*	......	......	......	......	......	100	......	......	......	......	65
Fort Worth, Tex.	*	*	*	......	*	......	......	......	......	......	......	......	70
Salt Lake, Utah	*	*	......	*	......	......	......	100	......	......	......	......	66
Cheyenne, Wyo.	*	......	......	*	......	......	......	......	......	......	100	......	85
Laramie, Wyo.	*	*	......	......	......	......	*	......	......	100	......	......	66
Seattle, Wash.	*	......	......	......	*	......	......	......	......	......	100	......	85
Sacramento, Calif.	......	*	......	*	......	......	......	......	......	100	......	......	80
San Francisco, Calif.	*	*	......	......	......	......	......	......	......	100	......	......	80
Montreal, Que.	*	......	......	......	......	......	*	......	......	......	......	100	80
Total	38	32	11	8	4	4	15	25	3	4	4	......	......

Small Plant, Fast Follow-Up, Quick Service Get Business

New Producer in Over-Produced City Grabs Off a Good Share of the Available Jobs

By Lucius Flint
Denver, Colo.

Editor's Note

THE EDITOR does not necessarily endorse the methods of getting business described in this article, nor most assuredly does he wish to encourage new producers to come into an industry already much over-produced.

But, it is hoped that this article will drive home forcibly to many established producers the absolute necessity of being always on their toes in keeping up with the trend of the times.—The Editor.

STARTING OUT with small backing, a limited acquaintance among local business men and no actual connections, last summer a new sand and gravel producer in Denver, Colo., built up a trade averaging \$10,000 a month. Particularly remarkable is the achievement of this company in view of the fact that solicitation work was handled entirely by two men, the president, John Scarpino, and Henry M. Parchen, a salesman who devotes his time almost exclusively to this work.

Mr. Scarpino attributes his success to a "Johnny-on-the-spot" method of solicitation. "The conventional but too often unsuccessful building permit follow-up system used by many firms in soliciting business, has lost much of its effectiveness in recent years, due to the increased speed with which deals are closed and contractors put to work," said Mr. Scarpino. "By the time a building permit makes its appearance in a daily paper or a legal publication, and the gravel man is able to get in touch with the contractor, the job is often well under way or in the case of a small construction project completed.

"We have secured a major portion of our business through constant personal contact with contractors, rather than through a follow-up of building permits. Going down the list of Denver contractors, we made the acquaintance of every one immediately upon opening our pit. Picking out those firms which had no definite arrangement with another Denver gravel concern, we concentrated our efforts upon them, calling upon them at intervals of a week or two.

"After securing the patronage of these men and building up a good feeling among them, we went after the other Denver contractors, playing up the service element rather than price or quality of our product. We have found that what the contractor is interested in today is quick service. Time limits are assuming an increasingly important place in the average contract between contractor and owner, and as a result, contractors are willing to pay a premium for service."

In selling to contractors who had dealt with various other firms, the Metropolitan firm used the argument that long established companies having a good trade might have become independent and in the rush of heavy volume, fail to give the best of service. "We don't care who you have been dealing with, but if you haven't been thoroughly satisfied with service, give us a trial; we are new, we need your business and we'll make deliveries when you want them, no matter what the cost," was their appeal.

Check Building Permits at City Hall Instead of Waiting Publication

Contractor contacts are supplemented by a building permit follow-up handled in this way. Shortly before the close of the city building inspection department each day, a representative of the Metropolitan firm calls at the city hall and gets a list of the permits issued that day. This advance information enables the firm to "get on the job" before publication of the permits. Although many sales are made in this way, such a program is not thoroughly efficient without a constant personal touch with contractors, according to Metropolitan company officials.

Advertisement (nearly actual size) used in Classified Telephone Directory

Married Drivers Between 30 and 40 Years Best

Peter Horn, truck foreman for the Metropolitan firm, answers the question, "What type of drivers are most efficient?" in this way, "Married men between 30 and 40 years of age; they are old enough to have had considerable experience in driving and finding it necessary to support families, they will work harder than younger men." Mr. Scarpino attributes a large share of his business to selection of drivers who are able to make fast time on the road, yet have the judgment to avoid accidents which delay deliveries.

The most effective advertising medium ever used by this firm has been an illustrated classified telephone directory, according to officials. In this advertisement, the service element is emphasized pictorially, a "cut" showing five Metropolitan trucks being loaded at the bins. This idea is further brought out by action in the sketch, several men being shown at work.

Specifications for Concrete and Aggregate

SPECIFICATIONS for concrete and concrete materials were a subject for discussion at a recent meeting of the Western Society of Engineers. J. P. H. Perry, vice-president of the Turner Construction Co., discussed them first from the standpoint of a producer of concrete. He was strong for brief specifications in which the specification writer contented himself with saying a thing only once. Also he wanted the specification writer to assume the responsibilities that he should and not to use ambiguous words and phrases.

He finds fault with many specifications because: (1) They do not pay sufficient attention to the size and grading of the aggregates available in a given locality. (2) There is a tendency to keep the maximum size of aggregates too small, specifying ¾-in. where 1¼-in. would do. Within certain limits the larger size makes the more economical concrete. (3) The old volume proportions (1-2-4 and so on) are still specified in addition to specifying strength and water-cement ratio. This is confusing and costly. If codes make it necessary to use volume proportions, only volume proportions should be specified. Generally speaking the specification has said enough when it specifies the water-cement ratio and says that aggregates should be added to make a plastic and workable concrete. The producer should have a chance to select aggregates of a suitable size and grading. (4) If admixtures and waterproofing compounds are to be used, the kind should be definitely specified and no such expression as "a satisfactory waterproofing compound" should ever be used. (6) For large and important work it would be well for the architect and engineer to examine all the available aggregates and test them and specify the proportions to be used along with the water-cement ratio. This will save the consumer money, because if the contractor has to guess he will guess on the safe side.

Today, Mr. Perry says, by requiring that the standard specifications of the Portland Cement Association, the American Society for Testing Materials, and the American Concrete Institute be followed exactly, the consumer can be assured of satisfactory concrete by specifying only the water-cement ratio and stating that the aggregates shall be such as will produce a satisfactory and workable concrete.

Arthur Lord, speaking for the consumers of concrete, said that he believed that time would simplify some of our specification problems. The mixing of concrete is rapidly passing to central mixing and batching plants where better equipment and control should be secured. Time will add new problems, new materials, new machines, new data of research. Old ideas, once successfully tried out, will prove to be workable under new conditions.

The standardization of concrete and concrete materials he thought was in the far distance. The best interests will be served by recognizing that concrete is a family of materials instead of a single material, and no group or society can comprehend all the useful variations to which concrete is susceptible under proper and complete control.

Investigations of Highway Concrete

BULLETIN No. 7 of the National Crushed Stone Association is made up of articles by A. T. Goldbeck, director of engineering, which have been published in the *Crushed Stone Bulletin*. All have been printed in abstract form in ROCK PRODUCTS. But in the Bulletin the articles have been somewhat condensed and are edited and arranged to form a very readable as well as valuable monograph on concrete for highways.

The first section shows the paramount importance of resistance to cross bending. This resistance, it is shown, may vary very considerably with the characteristics of the coarse aggregate used, so much so that there is no consistent relation between water-cement ratio and flexural strength when different aggregates are used. Proportioning of concrete materials is next discussed and it is shown that the use of arbitrary proportions such as 1:2:3½ and 1:2:4 is illogical and does not always produce concrete of the desired strength and workability. The ideal proportions are those which will give beam rather than compressive strength.

When tested with the same cement factor (6.3 sacks per cu. yd.) structurally weak gravels and smooth gravels were found to give lower flexural strengths. It was also found that there is no definite relation between compressive and flexural strength, for weak aggregates may produce high compressive and low flexural strengths.

The well-known method devised by Mr. Goldbeck for designing concrete for any desired flexural strength is explained in the final section of the book.

New Methods of Making Bituminous Roads

IN a paper delivered before the Association of Asphalt Paving Technologists, at Detroit, George W. Craig described new mechanical methods of making mixed-in-place bituminous roads. The equipment consists of two units, the first a loader-mixer which picks up the aggregate from the subgrade, measures and mixes it and deposits it either on the roadway or in the hopper of the machine which follows it. This second machine is the spreader-finisher and it spreads, tamps and screeds the coated aggregate, leaving it ready for the roller where rolling is desirable.

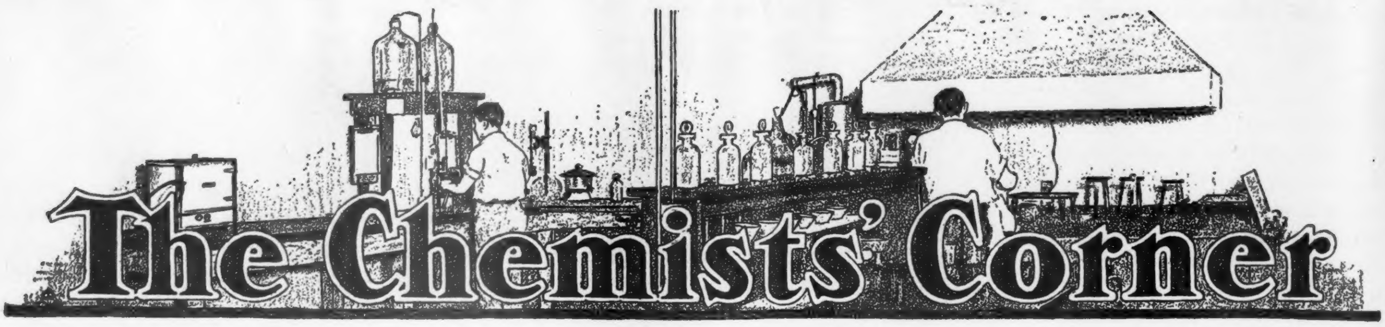
The loader-mixer has a heavy duty bucket loader combined with two spiral conveyors on an apron that pick up any aggregate that may escape the buckets. From the hopper into which the buckets discharge it the aggregate is carried through a calibrated gate and baffles to a twin pug mill. The gate and a meter attached to the conveyor give exact measurement of the aggregate and the bitumen is sprayed on it to correspond. Instruments give accurate volume and thermostatic control of the bitumen.

The spreader-finisher distributes the material by two spirals. Behind these is a tamper operating at 200 impacts per minute. The 6-in. screed behind operates on a half cycle with the tamper. It has a slight horizontal as well as a vertical movement.

The paper claims that by using these methods less bitumen is needed and the quality of the road is improved at the same time that the costs are considerably lowered.

Cleaning Sand on Tables

A RECENT ISSUE of the British paper, *The Quarry and Roadmaking*, says that a number of concentrating tables are now at work in the Manchester, England, area cleaning sand for making concrete. The description of the table reads something like that of the well-known Overstrom table used in copper and iron mining fields for cleaning ores. The shake is given by an unbalanced pulley and the table is supported on four springy legs of wood. A bumping post is added for sand treatment. The paper says that coal may be removed to less than 0.1% and will then pass the colorimetric test. In addition, tabling removes all loam and trash of every kind. In this country tables have been used for removing iron from glass sand, but they have been thought too expensive to maintain and operate for such a low-priced material as concrete sand.



Construction of Suction Filter

By Donald C. Paquet
Seattle, Wash.

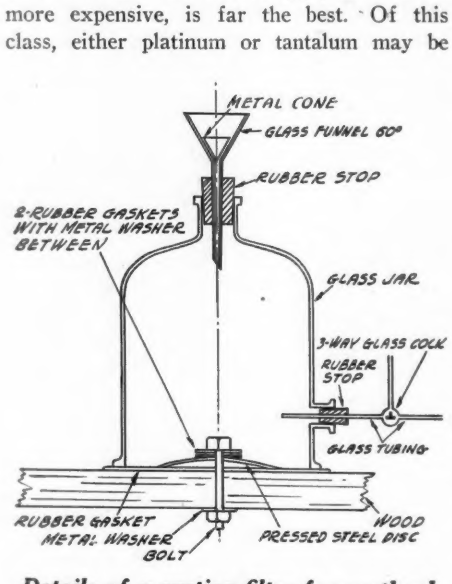
IN THE AVERAGE CEMENT PLANT laboratory the eternal cry from the powers that be is for speed and yet more speed, with the control determinations. It follows that the analyst who can turn out a greater number of determinations per day and still maintain his degree of accuracy becomes a more valuable man to his organization.

Probably all cement-plant chemists faced with a situation of this kind have at one time or another found themselves with a slowly filtering solution and time pressing. The temptation under pressure to scamp the washing is great; and we have all tried various and sundry fancy pleating of filter paper in our endeavor to speed up the filtering. The ordinary 60 deg. funnel today is a much better article than it was 15 years ago, but even today this writer has a set of funnels each one of which requires a slightly different folding of the filter to make it work at its maximum efficiency.

The answer to some of this is the use of suction filtration. This, too, has its limitations, but even so it may help in some cases. The instances where it becomes particularly applicable seem to be where two or three samples only are being carried along together. It is quite possible to build a machine which would handle a larger number, but a set-up of two is about all that one man can conveniently handle. This writer has used two of these set-ups with complete success for ten years, and during his visits to other laboratories here, and on the East Coast, he has been puzzled not to find other installations of a like nature.

There are two or, if we include the Gooch crucible method, three types of apparatus which are common. The first is the filter flask type, which by comparison is impractical unless the final manipulation of the filtrate may be in the filter flask itself. The second type, or Gooch, is too cumbersome and time-consuming for control purposes. The third, as described in this article, meets the requirements of speed and ease of handling.

The drawing is self-explanatory except for one or two points. The use of a perforated cone in the funnel is, of course, obligatory. There are two types: the porcelain and the metal. The second type, while much more expensive, is far the best. Of this class, either platinum or tantalum may be used. Today the tantalum cone may be purchased at an extremely reasonable figure. It is a metal which is unusually resistant to acids and has a higher degree of rigidity than platinum, holding its shape better. It is also much less expensive.



Details of a suction filter for portland cement laboratories

Suction Seal Important

The suction seal between the bell jar and the top of the bench is the all-important point. The bottom edge of the bell jar is usually ground, and the neatest job would be a piece of plate glass for a bottom joint. This writer has tried that method with various kinds of lubricant for a seal, with only indifferent success. The plate was never exactly plane, so that considerable air could leak in. In addition, the use of lubricants meant that when breaking the seal the bell jar would occasionally come free with a jerk, upsetting the filtrate beaker inside. Added to this, the lubricant was continually becoming smeared on glassware and apparatus. After experimenting with several different combinations the one illustrated in the accompanying sketch worked the best.

Referring to the drawing, the top of the bench must be a reasonably plane surface. The rubber gasket may be ordinary packing rubber. The pressed steel disc should be slightly dished, and the under edge ground off flat, so that when it is drawn down tight with the bolt it will not cut into the rubber. This disc should be large enough to leave only about ½ in. between its edge and the glass jar. When drawing down tight to the bench top, the nut on the bolt should be on the under side of the bench top so that there will be less chance of tearing the rubber washers underneath the bolt head.

The use of a three-way stop-cock in the side tubulature is obvious. It permits the suction to be instantly cut off, maintained, or normal pressure gradually restored in the bell jar. The side opening of the cock may also be used for such purposes as filling ammonia pipettes, etc.

In order that the filtrate beaker may rest steady inside the bell jar, a block of neat cement may be molded around the bolt head and extending out over the metal disc. Beakers of small size may be raised up to the tip of the funnel with wood blocks of suitable thickness. Water is used to complete the suction seal between the bell jar and the rubber gasket. Any leak quickly shows up.

Many applications for the use of this piece of apparatus will suggest themselves. It is particularly useful for the filtration of silica. In filtering gelatinous precipitates like R_2O_3, precautions must be used to employ a gentle suction at the start, and to add macerated filter pulp to the solution before precipitating.

The set-up may be located at any con-

venient spot on the work bench and be connected to the filter pump with copper tubing. A sufficiently long piece of heavy wall rubber tubing connecting the copper tubing with the glass stop-cock is advisable in order that the bell jar may be easily lifted away from the filtrate beaker. Unless nitric acid is used extensively, the copper tubing will last quite well, and is easy to replace with a new section when corrosion does eat through.

Needed Road Work Can Keep Millions Busy

"THAT PUBLIC WORK, such as road building, is one of the best ways for the country to furnish employment is shown in the actual employment figures in 1931," has declared W. C. Markham, executive secretary of the American Association of State Highway Officials.

"An average of approximately 290,000 men had road jobs on Federal Aid and state projects during 1931," Mr. Markham asserted. "It is conceded by those who have studied the subject that for every man working directly on the roads there is employment given two men who are preparing or transporting materials. On that basis the Federal Aid and state work alone was responsible for the employment of an average of 870,000 men throughout 1931. Local road work and street building brings the total number of men employed, directly and indirectly, in the improvement of automobile facilities to well over two million workers.

"To furnish work it is not necessary to avoid the use of machinery," Mr. Markham went on. "While it is true that the highest proportion of manual labor is found in hand-labor projects, such as working in virgin soil or spreading sand or gravel over an earth bed, it is also true that about nine-tenths of the road money spent for high type pavements also goes to labor. This is so because no intrinsically valuable materials go into roads; the hand of labor plays the major part in preparing these materials, in building equipment and in transporting these supplies to the project.

"The Federal government, the state and the local community can feel that when it makes a dollar available to road construction that it will be a dollar well spent, a dollar invested mostly in labor. Of great import, also, is the fact that this country needs many thousand more miles of good highways, highways that will cut down car operating costs to the individual and road upkeep costs to government. The public is now paying a tremendous tribute to these two items which can only be reduced by building adequate road surfaces.

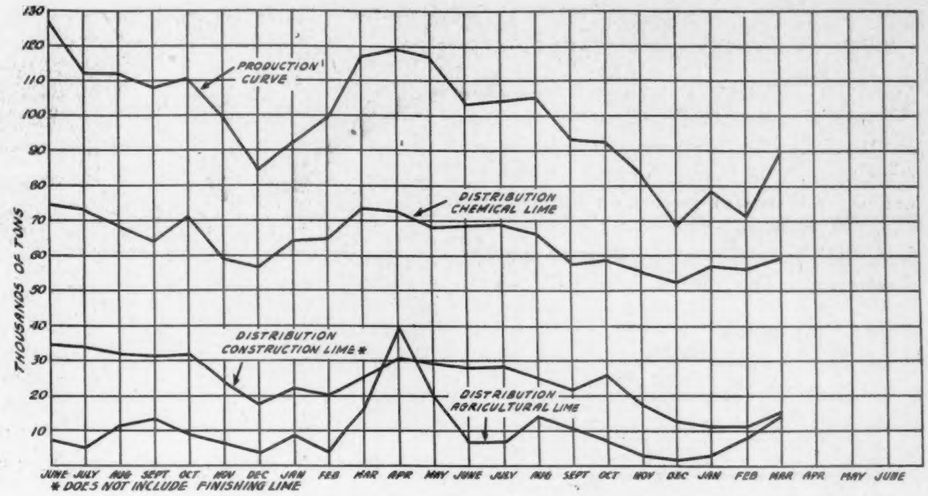
"The prevailing low construction prices, the economic need for improved highways and the all important call for more jobs make this a time when every community should devote every cent possible to roads," concluded Mr. Markham.

Lime Statistics to Be Discontinued

THE ACCOMPANYING CHART shows statistics of operations in the lime industry for a 21-month period ending with March, 1932.

This information, supplied by the National Lime Association, represents 50% of the total lime production of the country. Reasonable accuracy in estimating total production should be obtained from it by doubling the amounts shown in the chart.

The association announces that it is discontinuing the compiling and assembling of these statistics, the accompanying statistics bieng the last to be issued because of the necessity for economy. It is to be hoped that the work will be continued later.



Statistics of the lime industry to March 1, 1932

Consider Cement Plant in Arizona

A $2,000,000 cement plant, designed to fill the needs of the Boulder canyon project for the largest single order of cement ever placed in this country, will in all probability be erected somewhere between Las Vegas and Boulder City during the next 18 months, the *Kingman* (Ariz.) *Miner* reports.

Representatives of one of the largest cement concerns in the southwest have recently completed an investigation of the possibilities of such a plant, to furnish the material for the dam structure itself, and are understood to have reached the conclusion that cement can be produced in Nevada at a price some 28c a bbl. less than it can be shipped in from the outside.

First concrete on the dam proper will not be poured for some 18 months yet, reclamation bureau officials declared.

[Contracts for some of the cement for the Hoover dam have already been let to cement companies in southern California.—The Editor.]

Cement Manufacturers Stop Trucking into Milwaukee

FOUR cement manufacturers have discontinued trucking of cement at Milwaukee, Wis., from cement plants, says an announcement by the Wisconsin Retail Lumbermen's Association. All cement shipments from the four plants will be by rail only, it is stated.

The announcement follows opposition to the establishment of Milwaukee as a cement basing point. Dealers at recent meetings at Manitowoc and Milwaukee held that there was no apparent justification for making Milwaukee a basing point. Many dealers are against a lower cement price to dealers f.o.b. Milwaukee than to Wisconsin dealers outside of Milwaukee as unfair and discriminatory.

Individual expressions of opinions are that the trucking of cement both from cement plants and storage silos is a liability to cement dealers and a disturbing factor in the dealer distribution of cement. Dealers hold that the railroads are an economic necessity and that shipments of cement by rail only is equally as beneficial to all dealers as to the railroads.—*Chicago* (Ill.) *Journal of Commerce.*

Quarry Owner's Daughter Develops Road Material

A 23-YEAR-OLD college girl, Miss Katherine Vanderboom of Lannon, Wis., has perfected a cold asphalt road material.

The announcement of the achievement was made by Mount Mary college, Milwaukee.

Miss Vanderboom is the daughter of E. J. Vanderboom, owner of a stone quarry at Lannon, Wis.—*Chester* (Penn.) *Times.*

Cement Plant Built in Central Asia

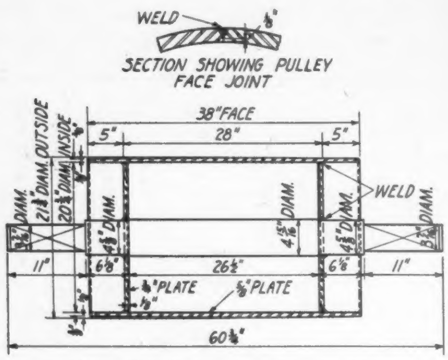
EARLY IN MARCH a large cement plant was to start operations at Kuvassy, in Soviet Central Asia, which is expected to produce 4,500,000 bbl. this year. All equipment in the basic departments has been assembled and is ready for operations.

Hints and Helps for Superintendents

Home-Made Pulley for Belt Conveyor

By E. H. Fleischman
Keystone Portland Cement Co., Bath, Penn.

WHEN TWO extra heavy cast iron pulleys on the traveling tripper of the 36-in. belt conveyor carrying stone from the crushing plant to storage broke, we had only one spare. It was impossible to wait on shipment of another so the necessary pulley was made up as shown in the accompanying illustration. The face of the pulley was



Shop-made conveyor pulley

rolled out of ⅝-in. steel plate by a local plate shop. This was welded at the joint by our own welder, who also cut out the two end discs from plate in stock. The machinist had meanwhile turned the shaft, leaving enough stock at the bearings for finishing. The welder then welded the shaft, discs and rim into a solid unit. The whole pulley was then placed in the lathe, the outside crown faced and the shaft turned to size. The cast iron pulley in stock and this home-made pulley were then placed together in service on the traveling tripper.

In about six weeks we made another home-made pulley just like the first one to replace the cast iron pulley we had put in at the first breakdown. Both of these home-made pulleys have been performing satisfactory ever since and apparently their life is indefinite.

Electric Welding Outfit Made Portable

A FEW YEARS AGO an electric welding outfit in a sand and gravel plant was rather rare, but today, owing to the satisfactoriness of the work done by such a tool, electric welding outfits are becoming common in the rock products industries.

Portable electric welding equipment is transported between plant and pit

At the plant of the Makins Sand and Gravel Co., Sulphur, Okla., the gravel being treated is a cemented conglomerate requiring blasting to loosen if for shovel loading. The pit operation can be said to be about halfway between a sand and gravel pit and a stone quarry. Hence the wear and tear on equipment in the pit is severe and above the average for sand and gravel plants.

To keep the haulage equipment (trucks), shovel, etc., and other loading equipment in repair, a General Electric welding outfit, mounted on a Federal truck, is provided as shown in the illustration. This can be shifted to the point of use, be it either the plant or the pit, without delay.

Operating Shovels at High Altitudes

THOSE contemplating the use of shovels in rock products operations at high altitude should not overlook the fact that gasoline engines lose power at the rate of 3.1% for each 1000 ft. above sea level.

On a road widening job into Yosemite Park the contractors were working their Link-Belt 1½-yd. shovel at elevations up to 9000 ft. above sea level. At this elevation the power loss would be about 28%.

While power losses due to altitude can be partly compensated for by equipping the engine with special heads, nevertheless it means that a shovel that scarcely has any reserve power at normal levels of operations, surely cannot be expected to function at 8000 or 9000 ft. above sea level.

Reserve engine power is valuable even at normal levels of operation, but at high altitude it becomes a necessity, if the size of the bucket is not to be reduced.

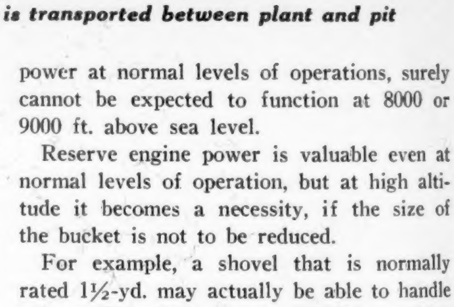
For example, a shovel that is normally rated 1½-yd. may actually be able to handle only a 1¼-yd. bucket, or smaller, at high altitudes. It all depends upon how conservatively the shovel manufacturer has "rated" the machine and its engine power.

Another need for reserve engine power on the above job was the fact that the shovel had to work in boulders and rock slides.

Simple Use of Geometry in Joining Pipes

By John Alden
Evanston, Ill.

WHEN pipes intersect on the center lines or meet at right angles it is not very difficult to make templets and, with a suf-



Making templets for intersecting pipes

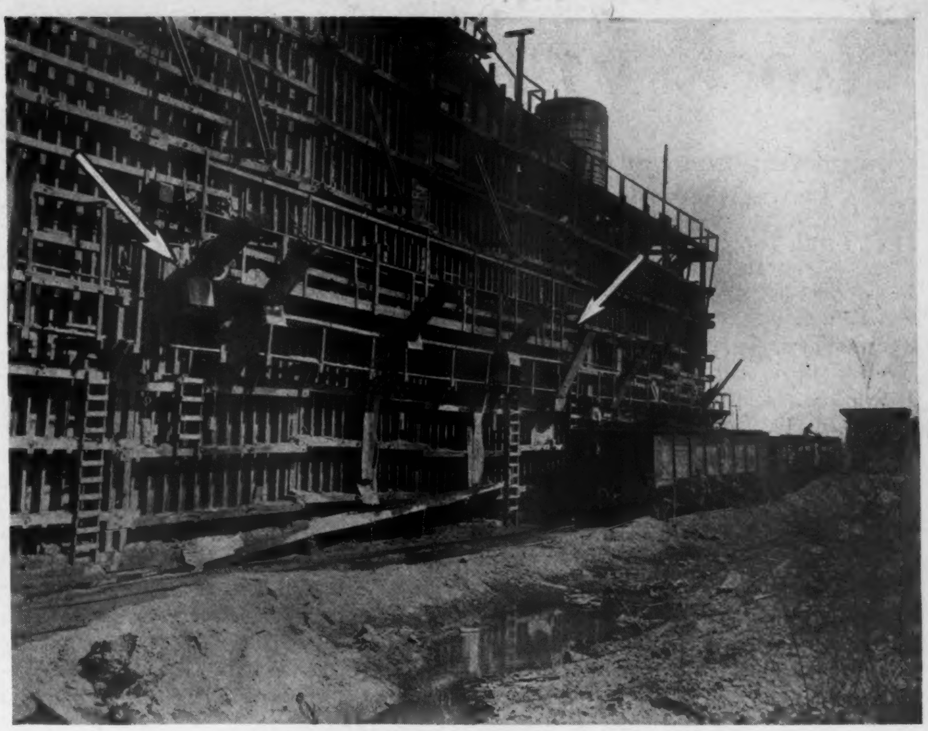
ficient knowledge of descriptive geometry, it is not impossible to make them for any kind of a connection.

Sometimes it is handy to know how to do this immediately in the middle of a job. What follows, in connection with the accompanying illustration, shows a method of laying out such connections.

On the end of the branch pipe mark off lines parallel to its longitudinal axis as indicated at *Y*. This can be done very conveniently by using a carpenter's square and a length of wood with a saw cut made in a mitre box so that it holds the square at right angles to the pipe, as shown at the left end of the main pipe.

Then block the branch pipe in the desired position and, with the square, measure the distance, *X*. Using this same distance, mark the points *AA*, *BB*, etc. on each of the lines *Y* and join these points by a curved line on each pipe. The pipes may then be cut with a torch on these lines and will be found to join correctly.

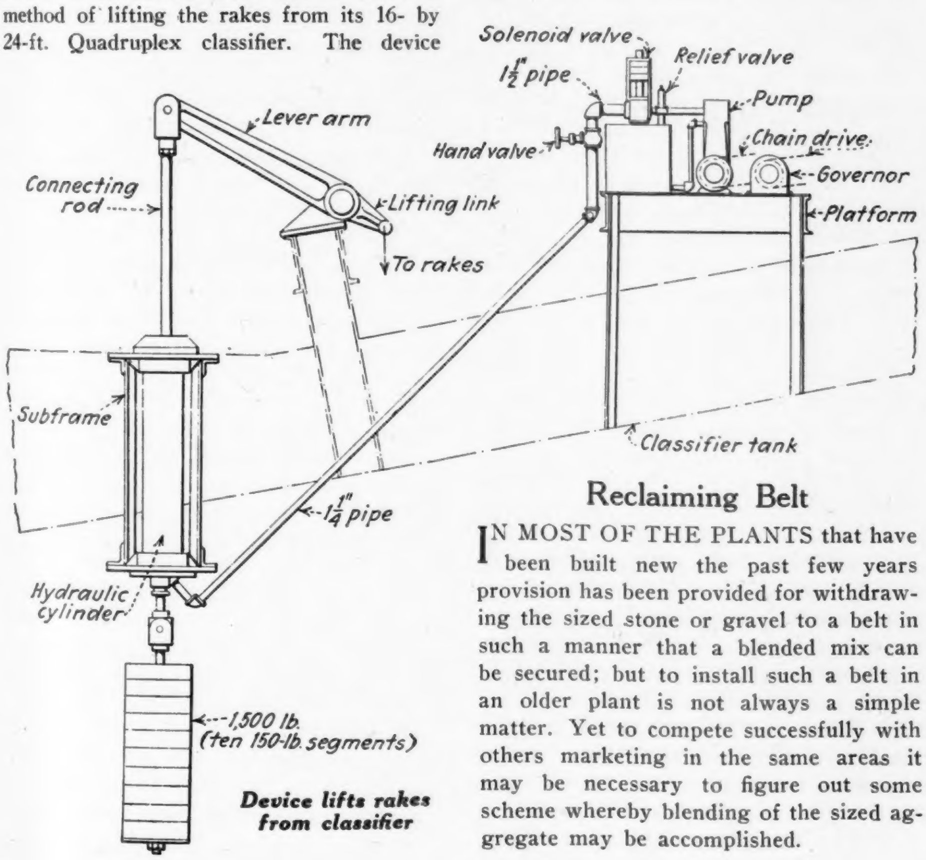
The use of a carpenter's square is convenient, although not necessary, as a straight stick or anything else can be used. It is quite easy to keep the stick parallel with the axis of the pipe.



Installation of belt for blending materials

Classifier Lifting Device

IF THE POWER GOES off leaving the rakes of a Dorr-type classifier embedded in sand, considerable time and labor must be lost in cleaning out the tank and freeing the rakes before the plant can be started. To avoid this the Climax (Colo.) Molybdenum Co. asked the Dorr Co. to devise a method of lifting the rakes from its 16- by 24-ft. Quadruplex classifier. The device adapted after a considerable study of different methods was a combination of hydraulic cylinders and counterweights, so that a cylinder has only to lift 300 to 400 lb. The rakes are returned by pumping liquid into the cylinders to lift the counterweights. The pumping is slow so that the rakes may be set in motion as they descend to clear out the settled sand in the tank.—*Engineering and Mining Journal.*



Device lifts rakes from classifier

Reclaiming Belt

IN MOST OF THE PLANTS that have been built new the past few years provision has been provided for withdrawing the sized stone or gravel to a belt in such a manner that a blended mix can be secured; but to install such a belt in an older plant is not always a simple matter. Yet to compete successfully with others marketing in the same areas it may be necessary to figure out some scheme whereby blending of the sized aggregate may be accomplished.

At the original plant of the Landers, Morrison and Christenson Co., near Minneapolis, Minn., this was accomplished by mounting the conveyor on a shelf paralleling the various storage bins in such a manner that the different sizes of gravel can be drawn to the belt and discharged direct to the gondolas on the loading track.

The knee braces supporting the conveyor also support a walkway for the convenience of the operator.

Protecting Electric Cables in Quarries

By W. E. Warner
Welwyn Garden City, Herts, England

ELECTRIC CABLES in quarries are exposed continually to mechanical damage. Armoring is not usually possible because it reduces flexibility.

The best way to protect the insulation of the cables from cuts and abrasion is by covering them with old automobile tires. These should be cut in two, straightened out and the cable run through them. The tires can then be wound with rope to hold them together, and the cable can be drawn through them as required.

Where the cable has been cut at joints or connection points it should be wrapped securely with insulating tape and two coats of shellac varnish applied to protect it against moisture.

Connections to electric hand lamps frequently cause trouble because the wires have not been properly bound where they enter the socket. These should be wound with insulating tape extending from the uncut insulation over the metal of the socket.

Rock Products Clinic

Improving Sand and Gravel Dewatering Method

THE EDITOR: During the past three years we have pumped from pit to a dewatering bucket elevator, thence to belt conveyor to plant. This method provides a splendid operation, but upkeep cost on the elevator is, in our opinion, comparatively tremendous. During the three years we have used this method, maintenance cost on elevator totals more than the original new cost, and we are now faced with the necessity of an expenditure of about 50% of original cost if we continue to use this elevator another year.

Some time ago I noted in ROCK PRODUCTS an article describing and illustrating a set of dewatering bins in "tandem" formation, and I would like to inquire whether you personally know anything about the actual result obtained from these bins as dewatering agencies.

Suppose we have a set of six bins, each holding about a carload, designed with sloping bottom, and plan our operation to have all six bins filled before shutting down the pump at night, can you say from actual observation from a similar operation that we could start the pump the next morning after emptying one bin and go right along through the day without undue delay caused from failure of material to be sufficiently dewatered from bin to bin to carry on the belt?

If we should install bins, we would set them out in the lake about 600 ft. from the end of our present inclined conveyor and transport material by horizontal conveyor to the end of present inclined conveyor.

"A MID-WEST OPERATOR."

* * *

Edmund Shaw's Reply

"I cannot say from actual observation that your proposed layout would work. I never saw an installation quite like it. But I see no reason why it should not work in principle. For example, if you had three bins, each holding a day's run, one could be filling while the next was being emptied and the third was draining. This would give 24 hr. for draining, which should be enough for any ordinary material with the proper kind of draining bin.

"I assume that you know about the way the material will behave in the bin, because some materials after draining set pretty hard, especially if they have many large pieces and the right amount of fines to fill the voids well. It takes a lot of poking and shoveling to keep such material running to the belt. But as I remember your material, not much of it exceeds 2½-in. diam. and it is pretty clean as taken from the lake.

"There used to be some plants near you in which drainage bins filled by cableway draglines were used in the way you suggest.

"Your idea of setting the draining bins out in the lake and conveying to the shore plant with a 600-ft. conveyor belt is novel and worth careful consideration. It would be cheaper to operate than a booster pump and the belt should last well if properly protected from the weather.

"But, personally, I do not like the method of draining or dewatering in bins, for it strikes me as slow, crude and somewhat uncertain. There are several alternatives. One that I like is to pump to a screen of some kind, probably a large gravity screen would do in your case, to take off the gravel. This would go to a small hopper that would feed to the conveyor belt. The sand and water going through the screen would go to a sand drag which would draw out sand dry enough to go on the belt. If properly arranged the sand would go to the belt first to make a bed on which the coarse would fall. I think that this would cost less to install and be more satisfactory in other ways than any drainage bin system.

"There are many ways of dewatering a pump discharge and getting the solids to the screens. I think I listed 15 different methods or combinations of methods I had seen in use when I made a study of the subject a few years ago. It is hard to tell which one is the best for any particular set of conditions, for all 15 of them were developed for what seemed good and sufficient reasons to the designer. So a man can only give such an opinion as I have given here."

EDMUND SHAW.

Horizontal Air Receivers

THE EDITOR: In the April 9 issue of ROCK PRODUCTS is a number of suggestions for the installation of compressed-air receivers. One recommendation, illustrated by a sketch, is that the horizontal receiver have the air inlet near the bottom at one end and the outlet at the top near the other end; the idea being that the receiver will thereby be "air-swept," which ". . . will prevent the building up of pockets of explosive gases."

Now, there cannot be any "pockets" of explosive gases. Either the receiver is full of "explosive gases" or it is not. There cannot be any segregation, or separation, of the gases and the air. The kinetic energy of the gas molecules will produce an intimate mixture by diffusion of all the gases entering the receiver. What is to be feared is the formation of an explosive mixture of the oil-vapor and the air which, should it be ignited, would explode with terrific force.

An objection to placing the air inlet near the bottom of the receiver, as shown in the sketch, is that in the event of neglect to blow off the accumulation of water and oil, it would rise and become entrained with the entering air and be carried into the discharge line. A better arrangement would be to admit the air through the head near the top of the receiver, with an internal pipe directed toward the other end. With the discharge in the shell at the same end as the inlet, the air would be compelled to sweep forward and then back, giving a maximum of travel and cooling effect.

The use of a steam-boiler as a receiver was condemned as bad practice. It was stated that, ". . . the large areas of pipe (tubes?) in such receivers are excellent surfaces on which oil from the valves can collect and vaporize." How oil can vaporize on a tube the other side of which is exposed to the outside air is not clear. The tubes would have the opposite effect.

I would consider a steam-boiler the very best kind of air-receiver. Set vertically, the outside air would rise through the tubes by convection and effectively cool the air in the receiver. If you have an old return-tubular steam-boiler, and an inspection proves it strong enough for the purpose, be assured that you cannot find a better air-receiver. It should be set vertically for best results.

One of the outstanding faults in the operation of air-compressors is the too-liberal use of cylinder lubricating-oil. Many operators seem to be impelled by the notion that if a little oil is good, a great deal is better. While an excess of oil in bearings is objectionable from the standpoint of cleanliness and cost, in air-compressor practice there is added the danger of explosion. Any oil beyond the needs of lubrication is a menace and should be guarded against. The operator of an air-compressor should learn what is the minimum quantity of oil that will insure good results and stick to that.

The bursting of a receiver is not necessarily a reflection on its material or workmanship. When you realize that the receiver is built for working pressures usually under 100 lb. per sq. in., and the ignition of an explosive mixture of oil-vapor and air produces a pressure upwards of 500 lb. per sq. in., you can understand why receivers sometimes "let go." Of course, receivers can be built to withstand the pressure of the explosion, but they would be extremely heavy and costly. Reasonable care in the use of lubricating oil, and frequent blowing off are simple and easy safeguards.

The advice to place the receiver at a distance from the compressor is good. In fact, it should be placed in a position where an explosion could do no damage to other objects. Fears of excessive pressure drop because of the longer piping are groundless because the connections usually provided with compressors are based on transmitting the air to great distances—sometimes thousands of feet. And if the receiver can be safely placed in the direction of travel of the air, then there is no loss from that cause.

C. O. SANDSTROM,
Thermal Engineering Co.,
Los Angeles, Calif.

Editorial Comment

Replacement Building

In the hurry to construct the buildings needed to house the people who have been crowding into our larger cities in the past decade, the necessity for replacing obsolescent structures has been overlooked. But the time is here when such replacement should be started. A large part, a very considerable part, of the business of the country is carried on in office buildings that were built a generation ago. Many of them are poorly planned for modern business. Their inadequacy shows in the headaches of the office workers that come from bad lighting and poor ventilation and the colds that come from sitting too close to a hot radiator or so far from one that the heating seems only a gesture. Such buildings were invariably built around a great open stairwell with elevator shafts that forms an excellent chimney to carry a fire from the ground to the roof. Far too much space was wasted in halls and stairways and heating costs more than it should for lack of insulation.

Living quarters for many city workers who earn moderate salaries are none too good. Many of them live in old style flat buildings, built before the 1893 World's Fair, when ideas of the space required for a family were generous. The typical flat of those days had its front parlor, back parlor, dining room, two bedrooms, kitchen, maid's room and bath. Now these rooms are divided to make two or three so-called apartments into each of which a family is crowded, to sleep around on cots and davenports, and fight the other families for the bathroom in the morning.

People can live that way because they have to live that way, just as they can work in inadequate office buildings because they have to work in them. But it is a sad reflection on our urban American civilization that they do have to. It cannot make good citizens. It breaks up families and destroys one's sense of what is right and proper and normal in living.

In Europe this is better appreciated than in the United States and in every important European country private and governmental agencies are doing much to provide better housing for those who earn small and moderate incomes. The United States ought not to allow itself to fall behind other countries in this work.

There should be no wholesale condemning of badly designed and built office and apartment buildings, but their inspection should be stiffened and the worst violators of the laws that require adequate air space, lighting, ventilation and heating should be condemned. These laws too might be improved and stiffened. More is implied than merely making folks comfortable. Our whole scheme of urban civilization rests on our ability to make conditions so that families can live in cities in a decent, orderly way, for the time is fast coming when the city must raise its own citizens if it is to endure.

Grades of Aggregates

At the 1931 National Sand and Gravel Association convention, P. J. Freeman said he could see no reason why the aggregate industry should not recognize that it produces first quality products and second quality products and not always a first quality product. Or, in other words, why should we not have two aggregate specifications, one for first class and one for second class material?

It is true that aggregates are produced in all grades from "not fit to be used" to as nearly 100% perfect as it is possible for such products to be. The quality is not wholly under the control of the operator. There are great areas where the exposed ledges of rock must be studied carefully and only the better portions chosen for aggregates, and there are other areas where some of the gravels are too fine or contaminated with shale and other soft materials. But aggregates must be produced locally if they are to be used at all, for competition with other construction materials demands that concrete should be made of materials that do not have to travel many miles to get to the job.

There is very little complaint about the quality of aggregates. Young's statement, that 75%, *at least*, of the disintegration of concrete is due to conditions on the job that the engineer in charge might have corrected, still stands. Recent studies of durability in aggregates and concrete have disclosed enough so that the engineer in charge should know how to detect unsound aggregates and refuse to use them. And he will not be called upon to refuse aggregates as not durable if he buys the product of a first class commercial plant which has a reputation to maintain. It is granted that there are differences in good aggregates, and that some need more cement than others for the same flexural strength. But this is a matter of surface texture or some other characteristic that does not affect the strength and permanence of the concrete at all.

Aggregate specifications should cover such things as durability, cleanliness, freedom from deleterious materials, grading and freedom from segregation, all of these being things that the producer can control. There should be no first or second quality for any of these; an aggregate is either clean enough or it isn't, for example. Such specifications will insure durable and permanent concrete if the mixing and placing are what they should be. The matters of cement factor, water-cement ratio and proportioning of fine and coarse aggregates are to be decided by the engineer in charge. If he finds an aggregate that really gives him what he wants in strength or appearance at a lower cost than another, that is the aggregate he should buy, provided it is up to good specification requirements in other respects. But first cost should never be the first consideration. If one investigates concrete failures due to dirty or unsound aggregates he is pretty certain to find that they were bought because they were cheaper than the sound aggregates which were available at a small increase in price.

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

Stock	Date	Bid	Asked	Dividend
Allentown P. C. 1st 6's[27]	5- 4-32	91	97	
Alpha P. C. com.[2]	4-30-32	6	7½	25c qu. Apr. 25
Alpha P. C. pfd.[2]	4-30-32	....	90	1.75 qu. Mar. 15
Amalgamated Phosphate Co. 6's, 1936[19]	4-29-32	75	....	
American Aggregates com.[19]	4-29-32	1½	3½	
American Aggregates pfd.[19]	4-29-32	5	15	1.75 qu. Jan. 1
Amer. Aggr. 6's, w.w.[19]	4-29-32	23	29	
Amer. Aggr. 6's, ex.w.[19]	4-29-32	22	28	
Amer. L. & S. 1st 7's[37]	5- 4-32	70	80	
American Silica Corp. 6½'s[39]	5- 4-32	No Market		
Arundel Corp. new com.[2]	4-30-32	15	17	75c qu. Apr. 1
Bessemer L. & C. Class A	5- 3-32	....	4	
Bessemer L. & C. 1st 6½'s[4]	4-29-32	....	23	
Bloomington Limestone 6's[27]	5- 4-32	....	25	
Boston S. & G. new com.[37]	4-29-32	4	6	15c qu. Apr. 1
Boston S. & G. new 7% pfd.[37]	4-29-32	25	35	87½c qu. Apr. 1
California Art Tile, A	4-28-32	1½	4¼	
California Art Tile, B[9]	4-28-32	....	5	
Calaveras Cement com.	4-28-32	⅛	2	
Calaveras Cement 7% pfd.	4-28-32	....	56	1.75 qu. Apr. 15
Canada Cement com.	5- 3-32	3⅜	4⅛	
Canada Cement pfd.	5- 3-32	36	39	1.62½ qu. Mar. 31
Canada Cement 5½'s[42]	4-30-32	67	75	
Canada Crushed Stone bonds[42]	4-30-32	60	70	
Canada Crushed Stone com.[42]	4-30-32	2	....	
Certainteed Products com.	5- 3-32	1¾	2⅛	
Certainteed Products pfd.	5- 3-32	7	9½	1.75 qu. Jan. 1
Cleveland Quarries	5- 3-32	....	54	10c qu. June 1
Consol. Cement 1st 6½'s, A[44]	5- 4-32	No market		
Consol. Cement notes, 1941[27]	5- 4-32	No market		
Consol. Cement pfd.[27]	5- 4-32	....	50	
Consolidated Oka Sand and Gravel (Canada) 6½'s[12]	4-29-32	80	85	
Consolidated Oka Sand and Gravel (Canada) pfd.[42]	4-30-32	....	50	1.75 qu. Oct. 10,31
Consol. Rock Prod. com.[35]	4-28-32	10c	20c	
Consol. Rock Prod. pfd.[35]	4-28-32	50c	1	
Consol. Rock Prod. units[35]	4-28-32	1½	2½	
Consol. S. & G. pfd. (Can.)	5- 3-32	....	50	1.00 qu. May 16
Construction Mat. com.	5- 4-32	....	2	
Construction Mat. pfd.	5- 4-32	2	4⅞	
Consumers Rock and Gravel, 1st Mtg. 6's. 1948[35]	4-28-32	38	42	
Coosa P C. 1st 6's[23]	4-29-32	....	30	
Coplay Cem. Mfg. 1st 6's[19]	4-29-32	35	50	
Dewey P. C. com.[47]	5- 4-32	85	95	
Dolese and Shepard	5- 3-32	14	16	$1 qu. Jan. 1
Dufferin Pav. & Cr. Stone pfd.	5- 3-32	....	30	1.75 qu. Apr. 1
Dufferin Pav. & Cr. Stone com.	5- 3-32	....	5	
Federal P. C. 6½'s, 1941[19]	4-29-32	65	70	
Giant P. C. com.[2]	4-30-32	2	4	
Giant P. C. pfd.[2]	4-30-32	7	10	1.75 s.-a. Dec. 15
Gyp. Lime & Alabastine, Ltd.	5- 3-32	2⅞	3⅛	10c qu. Oct. 5,'31
Gyp. Lime & Alabastine 5½'s[43]	4-30-32	50	55	
Hermitage Cement com.[11]	4-30-32	5	10	
Hermitage Cement pfd.[11]	4-30-32	30	40	
Ideal Cement 5's, 1943[20]	4-30-32	90	95	
Ideal Cement com.	5- 3-32	15	17	50c qu. Apr. 1
Indiana Limestone units[27]	5- 4-32	No market		
Indiana Limestone 6's	4-30-32	5 actual sale		
International Cem. com.	5- 3-32	8½	9⅛	50c qu. Mar. 31
International Cem. bonds, 5's	5- 3-32	58¼	Act. sale	Semi-ann. int.
Iron City Sand & Gravel 6's[36]	4-29-32	....	70	
Kelley Is. L. & T. new stock	5- 3-32	8	12	25c qu. Apr. 1
Ky. Cons. Stone com.	5- 3-32	....	2	
Ky. Cons. Stone pfd.	5- 3-32	....	50	
Ky. Cons. St. 1st Mtg. 6½'s[45]	4-29-32	30	40	
Ky. Cons. St. V. T. C.[45]	4-29-32	½	1	
Ky. Rock Asphalt com.	5- 3-32	1¾	2½	
Ky. Rock Asphalt pfd.	5- 3-32	20	25	1.75 qu. Dec.1,'31
Ky. Rock Asphalt 6½'s	5- 3-32	81½	85	
Lawrence P. C.[2]	4-30-32	8	12	
Lawrence P. C. 5½'s, 1942[2]	4-30-32	29	32	
Lehigh P. C. com.	5- 3-32	4	5	
Lehigh P. C. pfd.	5- 3-32	51	52	1.75 qu. Apr. 1
Louisville Cement[7]	4-28-32	125	150	
Lyman-Richey 1st 6's, 1932[13]	4-29-32	95	....	
Lyman-Richey 1st 6's, 1935[13]	4-29-32	90	....	
Marblehead Lime 6's[14]	4-29-32	No market		
Marbelite Corp. com.[35] (cement products)	4-28-32	3c	....	
Marbelite Corp. pfd.[35]	4-28-32	50c	....	
Marquette Cem. Mfg. 1st 5's, 1936[46]	5- 4-32	80	....	
Marquette Cem. Mfg. 1st 6's, 1936[46]	5- 4-32	90	....	
Material Service Corp.	5- 3-32	10½	11	
McCrady-Rodgers 7% pfd.[22]	4-28-32	30	35	87½c qu. Dec.30,'31
McCrady-Rodgers com.[22]	4-28-32	No market		75c qu. Jan. 26
Medusa P. C. pfd.[47]	5- 4-32	50	60	1.50 qu. Apr. 1
Medusa P. C. com.	5- 3-32	5	10	
Monarch Cement com.[47]	5- 4-32	65	70	
Michigan L. & C. com.[6]	4-30-32	45	....	
Missouri P. C.	4-19-32	6	8	25c qu. Jan. 30
Monolith Portland Midwest com.[9]	4-28-32	¾	1	
Monolith P. C. com.	4-30-32	1	2	40c s.-a. Jan. 1
Monolith P. C. pfd.	4-30-32	2	3	40c s.-a. Jan. 1
Monolith P. C. units[9]	4-28-32	8½	10	
Monolith P. C. 1st Mtg. 6's[9]	4-28-32	55	62	
National Cem. (Can.) 1st 7's[27]	5- 4-32	85	95	
National Gypsum A com.[27]	5- 4-32	¾	1¼	
National Gypsum pfd.[27]	5- 4-32	23	26	1.75 qu. Apr. 1
National Gypsum 6's[3]	5- 4-32	50	60	
Newaygo P. C. 1st 6½'s[27]	5- 4-32	76	....	
New England Lime 6's, '35[19]	4-29-32	5	15	
N. Y. Trap Rock 1st 6's	4-29-32	61	65	
N. Y. Trap Rock 7% pfd.[30]	4-29-32	....	35	1.75 qu. Apr. 1
North Amer. Cem. 1st 6½'s	4-30-32	18 actual sale		
North Amer. Cem. com.[27]	5- 4-32	¼	1	
North Amer. Cem. 7% pfd.[27]	5- 4-32	1	4	
North Shore Mat. 1st 5's[15]	5- 4-32	No market		
Northwestern States P. C.[47]	5- 4-32	25	30	
Ohio River S. & G. com.	5- 3-32	....	8	
Ohio River S. & G. 7% pfd.	5- 3-32	....	98	
Ohio River S. & G. 6's[16]	4-30-32	....	70	
Oregon P. C. com.[9]	4-28-32	8	12	
Oregon P. C. pfd.[9]	4-28-32	80	85	
Pacific Coast Aggr. com.[40]	4-14-32	....	½	
Pacific Coast Aggr. pfd.[40]	4-14-32	....	1	
Pacific Coast Aggr. 6½'s, 1944[5]	4-28-32	20	23	
Pacific Coast Aggr. 7's, 1939[5]	4-28-32	4	7	
Pacific Coast Cement 6's[5]	4-28-32	76	....	
Pacific P. C. com.	4-28-32	3	6	
Pacific P. C. pfd.	4-28-32	....	50	1.62½ qu. Apr. 5
Pacific P. C. 6's[5]	4-28-32	88	....	
Peerless Cement com.[1]	4-29-32	15c	25c	
Peerless Cement pfd.[1]	4-29-32	3	4	
Penn.-Dixie Cement com.	5- 3-32	½	⅝	
Penn.-Dixie Cement pfd.	5- 3-32	5	5½	
Penn.-Dixie Cement 6's	4-30-32	36 act. sale		
Penn. Glass Sand Corp. pfd.[19]	4-29-32	60	70	1.75 qu. Apr. 1
Penn. Glass Sand Corp. 6's[19]	4-29-32	81	....	
Petoskey P. C.	5- 3-32	1½	2½	
Port Stockton Cem. com.[9]	4-28-32	No market		
Riverside Cement com.[9]	4-28-32	....	12	
Riverside Cement pfd.[9]	4-28-32	55	60	1.50 qu. May 1
Riverside Cement, A	4-28-32	....	8	
Riverside Cement, B[9]	4-28-32	70c	1	
Roquemore Gravel 6½'s[17]	4-30-32	85	95	
Sandusky Cement 6½'s, 1932-37[19]	4-29-32	90	100	
Santa Cruz P. C. com.	4-28-32	....	70	$1 qu. Apr. 1
Schumacher Wallboard com.	4-30-32	1½ act. sale		
Schumacher Wallboard pfd.	4-28-32	....	20	50c qu. Feb. 15
Signal Mt. P. C. pfd.[47]	5- 4-32	4	7	
Southwestern P. C. units[35]	4-28-32	150	....	
Standard Paving & Mat. (Canada) com.	5- 3-32	1½	2	
Standard Paving & Mat. pfd.	5- 3-32	....	35	1.00 qu. May 16
Superior P. C., A	4-28-32	....	28	27½c mo. June 1
Superior P. C., B	4-15-32	5	5½	12½c Mar. 21
Trinity P. C., units[47]	5- 4-32	25	30	
Trinity P. C. com.[47]	5- 4-32	4	7	
U. S. Gypsum com.	5- 3-32	15½	16	40c qu. Mar. 31
U. S. Gypsum pfd.	5- 3-32	95	103¼	1.75 qu. Mar. 31
Wabash P. C.[21]	4-30-32	6	8	
Warner Co. com.[16]	4-30-32	3	3¼	25c qu. Oct.15,'31
Warner Co. 1st 7% pfd.[16]	4-30-32	....	50	1.75 qu. Apr. 1
Warner Co. 6's, 1944, with war.	4-29-32	....	60	
Whitehall Cem. Mfg. com.[19]	4-29-32	36	42	
Whitehall Cem. Mfg. pfd.[19]	4-29-32	38	45	
Wiscon. L. & C. 1st 6's, '33[15]	5- 4-32	50	....	
Wolverine P. C. com.	5- 3-32	....	3¼	15c qu. Nov.15,'31
Yosemite P. C. A. com.[9]	4-28-32	1	1½	

Quotations by: [1]Watling Lerchen & Hayes Co., Detroit, Mich. [2]Bristol & Willett, New York. [3]Rogers, Tracy Co., Chicago. [4]Butler, Beadling & Co., Youngstown, Ohio. [5]Smith, Camp & Riley, San Francisco, Calif. [6]Frederick H. Hatch & Co., New York. [7]J. J. B. Hilliard & Son, Louisville, Ky. [8]Dillon, Read & Co., Chicago, Ill. [9]A. E. White Co., San Francisco, Calif. [10]Lee Higginson & Co., Boston and Chicago. [11]J. W. Jakes & Co., Nashville, Tenn. [12]James Richardson & Sons, Ltd., Winnipeg. Man. [13]Stern Bros. & Co., Kansas City, Mo. [14]First Wisconsin Co., Milwaukee, Wis. [15]Central-Republic Bank & Trust Co., Chicago. [16]J. S. Wilson, Jr., Baltimore, Md. [17]Citizens Southern Co., Savannah, Ga. [18]Dean, Witter & Co., Los Angeles, Calif. [19]Hewitt, Ladin & Co., New York. [20]Tucker, Hunter, Dulin & Co., San Francisco, Calif. [21]Baker, Simonds & Co., Inc., Detroit, Mich. [22]Peoples-Pittsburgh Trust Co., Pittsburgh, Penn. [23]Howard R. Taylor & Co., Baltimore. [24]Richards & Co., Philadelphia, Penn. [25]Hincks Bros. & Co., Bridgeport, Conn. [26]Bank of Republic, Chicago, Ill. [27]National City Co., Chicago, Ill. [28]Chicago Trust Co., Chicago, Ill. [29]Boettcher-Newton & Co., Denver. [30]Hanson and Hanson, New York. [31]S. F. Holzinger & Co., Milwaukee, Wis. [32]Tobey and Kirk, New York. [33]Steiner, Rouse and Co., New York. [34]Jones, Heward & Co., Montreal, Que. [35]Tenney, Williams & Co., Los Angeles, Calif. [36]Stein Bros. & Boyce, Baltimore, Md. [37]Wise, Hobbs & Arnold, Boston. [38]E. W. Hays & Co., Louisville, Ky. [39]Blythe Witter & Co., Chicago, Ill. [40]Martin Judge Co., San Francisco, Calif. [41]A. J. Pattison Jr. & Co. Ltd., Toronto, Canada. [42]Nesbitt, Thomson & Co., Toronto. [44]E. H. Rollins, Chicago. [45]Dunlap, Wakefield & Co., Louisville, Ky. [46]First Union Trust & Savings Bank, Chicago. [47]Anderson Plotz and Co., Chicago, Ill.

Marquette Cement

THE balance sheet of the Marquette Cement Manufacturing Co., Chicago, Ill., as of January 1, 1932, and for comparative purposes, as of January 1, 1931, is reported as follows:

ASSETS	1932	1931
Property account	$18,239,783	$17,659,697
Current assets:		
Securities owned	1,197,446	1,654,404
Cash	829,402	1,273,035
Accounts and notes receivable	367,483	584,832
Inventories	1,630,279	1,407,093
Advances	4,325	5,700
Deferred charges	584,564	691,806
Prepayments	50,402	69,552
Total	$22,903,684	$23,346,119
LIABILITIES		
Preferred stock	$ 4,088,900	$ 4,309,700
Common stock	3,443,200	3,443,200
Bonded debt	3,745,000	4,015,000
Current liabilities:		
Accounts payable, etc.	375,588	568,486
Reserve for taxes	65,812	336,064
Interest payable	54,585	58,162
Reserve for depreciation and depletion, etc.	5,754,036	4,759,498
Surplus	5,376,563	5,856,009
Total	$22,903,684	$23,346,119
Current assets	$ 4,028,935	$ 4,925,063
Current liabilities	495,985	962,712
Working capital	$ 3,532,950	$ 3,962,351

Lehigh Cement Earnings Year Ended March 31

THE Lehigh Portland Cement Co., Allentown, Penn., reports for the year ending March 31, 1932, net profit after federal taxes, depreciation, depletion, etc.:

	March 31, 1932	December 31, 1931
12 months to	(d) $25,734	$ 79,928
Earned per share, preferred	nil	$0.40

Number of preferred shares, 197,594.

Missouri Portland Cement

THE annual report of the Missouri Portland Cement Co., St. Louis, Mo., for the year ended December 31, 1931, states that during the year, the company sold the buildings, equipment and inventory, pertaining to its commercial rock crushing department in Kansas City, to a subsidiary company organized in February, 1931, the Missouri Portland Cement Co. having acquired all of the capital stock of this subsidiary company for a cash consideration. The accounts of this wholly owned subsidiary have been consolidated with the accounts of the parent company in the annexed balance sheet.

Land, buildings and equipment are given at the depreciated book value of $7,467,781.16. Charges for additions to property accounts, aggregating $671,446.46 have been properly capitalized. Depreciation, in the amount of $474,384.30, and depletion of $10,442.95, has been charged to operations for the year 1931.

The inventory of manufactured cement has been priced on the basis of the lower of cost or market, and the inventories of materials, supplies and sacks are priced at cost.

CONDENSED CONSOLIDATED BALANCE SHEET OF THE MISSOURI PORTLAND CEMENT CO. AND WHOLLY-OWNED SUBSIDIARY

(At the close of business December 31, 1931)

ASSETS				
Capital assets:				
Land, buildings and equipment—book values, less allowances for depreciation and depletion			$7,467,781.16	
Stock in subsidiary company			2,421,840.20	$ 9,889,621.36
Good will, trade marks, trade brands, trade names, etc.				1.00
Current				
Cash on hand and on deposit			$ 224,896.41	
Customers' accounts receivable, less allowance for doubtful, discount and freight			70,576.55	
Accrued income			58.13	
Inventories—				
Manufactured cement		$ 397,278.06		
Clinker (cement in process)		38,434.09		
Other merchandise		9,312.96		
Miscellaneous stores, supplies, etc.		411,553.68		
Cement sacks		173,929.88	1,030,508.67	1,326,039.76
Sundry notes, accounts, claims, etc.				245,578.40
Sundry securities				135,250.00
Deferred				59,926.80
				$11,656,417.32
LIABILITIES				
Current				
Accounts payable			$ 78,651.80	
Accrued local taxes and sundry expenses			13,154.28	$ 91,806.08
Reserve for sack redemption				18,316.13
Other reserves				122,861.71
Capital stock and surplus				
Capital stock: Authorized 360,000 shares—Par value, $25		$9,000,000.00		
Less: Unissued 60,716 shares	$1,517,900.00			
In treasury, 10,915 shares	272,875.00	1,790,775.00	$7,209,225.00	
Surplus:				
Capital surplus-discount on purchased treasury stock			62,283.65	
Appropriated surplus			1,500,000.00	
Unappropriated surplus:				
Balance, December 31, 1930	$3,492,376.63			
Add: Sundry adjustments—net	16,200.38	$3,508,577.01		
Deduct:				
Net loss for year ended Dec. 31, 1931	$ 335,353.26			
Cash dividends paid	521,299.00	856,652.26	2,651,924.75	11,423,433.40
				$11,656,417.32

Penn.-Dixie Earnings for Year Ended March 31

THE Pennsylvania-Dixie Cement Corp., New York City, reports for 12 months ended March 31, 1932, operating profit of $553,227 comparing with $2,594,627 in 12 months ended March 31, 1931, and net loss of $1,455,699 after depreciation, depletion, interest, etc., comparing with net income in 12 months of $467,202, equivalent to $3.44 a share on 135,888 shares of 7% preferred stock.

Current assets as of March 31, last, including $2,864,982 cash and short term securities, amounted to $5,406,465, against current liabilities of $245,074.

Consolidated income account for 12 months ended March 31, 1932, compares as follows:

	1932	1931	1930
Operating profit	$ 553,227	$2,594,627	$2,479,723
Depreciation and depletion	1,390,534	1,381,716	1,393,314
Interest	618,392	657,754	700,285
Federal taxes	....	87,955	56,988
Net loss	$1,455,699	*$467,202	*$329,136

*Profit.

Recent Dividends Announced

Cleveland Quarries com. (qu.)	$0.10,	June 1
Consolidated Sand & Gravel, Ltd., pfd. (qu.)	1.00,	May 16
McNeel Marble pfd. (qu.)	1.50,	Apr. 15
Standard Paving & Materials pfd. (qu.)	1.00,	May 16
Superior Portland Cement Cl. A (mo.)	0.27½,	June 1

Consolidated Rock Products

THE Consolidated Rock Products Co., Los Angeles, Calif., producer of sand, gravel, crushed stone, ready-mixed concrete, etc., reports for the years ending December 31, 1931 and 1930:

CONSOLIDATED INCOME ACCOUNT

	1931	1930
Net sales	$3,657,326	$4,331,488
Costs and expenses	2,728,276	3,704,817
Depreciation, depletion and amortization	*829,419	950,295
Operating income	99,631	(d)323,624
Other income	96,977	23,107
Total income	196,608	(d)300,517
Bond interest	203,997	225,175
Amortization of discounts, etc.	20,261	94,567
Net loss	27,650	620,259
Dividends	....	262,500
Deficit	$27,650	$882,759

*From January 1, 1931, to September 30, 1931, computed approximately on cost to owning companies, which is comparable with basis used in prior years, $702,256; from October 1, 1931, to December 31, 1931, computed on reappraised values effective October 1, 1931, $127,163.

During the year the company went through a financial reorganization shown in the balance sheet below. The paid in surplus account as of December 31, 1931 comprises the paid in surplus as of December 31, 1930, less dividends and operating deficit, $2,091,571; less adjustments determined and recorded during 1931, net $52,148, leaving a balance of $2,039,423. From this was deducted the operating loss from January 1, 1931 to September 30, 1931, amounting to $30,389; reductions in property valuations of the consolidated companies, effective October 1, 1931, and cost of preferred

shares held in the treasury ($8,485,031, less reduction of capital of parent company, effective October 1, 1931, leaving $6,494,909) or $1,990,122. The total deductions from 1930 surplus are therefore $2,072,659, leaving a paid in surplus as of December 31, 1931, of $18,912.

CONSOLIDATED BALANCE SHEET AS OF DECEMBER 31

Assets:	1931	1930
Property account	*$4,116,209	$13,371,546
Lease deposits	1	....
Investments in controlled companies	70,218	53,778
Current assets:		
Cash	328,703	188,755
Life insurance, cash value	3,256	....
Accounts and notes receivable (net)	267,584	523,082
Inventories	108,354	121,284
Bonds of subsidiaries	....	55,700
Unamortized bond discounts	228,885	283,778
Other assets	27,804	70,703
Other accounts receivable	67,148	....
Prepaid items	110,840	141,218
Total	$5,329,003	$14,809,844
Liabilities:		
†Preferred stock	$1,800,000	$7,500,000
‡Common stock	1	794,910
Minority interest	289	503
Funded debt	3,174,000	3,637,000
Current liabilities:		
Accounts payable and accruals	196,694	356,259
Bank loans	....	100,000
Notes and contracts payable	49,511	253,090
Other notes and contracts payable	27,000	76,511
Reserve for contingencies	56,725	....
Paid-in surplus	18,912	2,091,571
Earned surplus	§5,871	
Total	$5,329,003	$14,809,844
Current assets	$707,897	$833,121
Current liabilities	246,205	709,349
Working capital	$461,692	$123,772

*At reappraised values made effective October 1, 1931, plus subsequent additions at cost less provision for depreciation and depletion. †Represented by no par shares: 1931, 285,947; 1930, 300,000. ‡Represented by 397,455 no par shares. §Net profit for three months ended December 31, 1931.

Pennsylvania Glass Sand Corp.

THE Pennsylvania Glass Sand Corp., Lewistown, Penn., reports a balance sheet for the year ending December 31, 1931 (as compared with December 31, 1930):

ASSETS

	1931	1930
Property, plant, etc.	$13,637,990	$14,011,200
Current assets:		
Cash	231,109	189,712
Accounts and notes receivable	434,937	447,784
Inventories	121,503	127,680
Securities	424,190	450,431
Deferred accounts	333,111	367,231
Sinking fund	64,072	86,949
Total	$15,246,912	$15,680,988

LIABILITIES

	1931	1930
Capital and capital surplus	$8,669,878	$8,984,482
Earned surplus	986,855	1,000,334
Bonded debt	4,580,000	4,694,000
Current liabilities:		
Accounts payable	194,506	199,125
Accrued accounts	18,865	41,803
Interest and dividends payable	181,584	185,021
Reserves	615,224	576,222
Total	$15,246,912	$15,680,988
Current assets	$1,211,739	$1,215,607
Current liabilities	394,955	425,949
Working capital	$816,784	$789,658

Giant Portland Cement

THE Giant Portland Cement Co., Philadelphia, Penn., reports for the year 1931 earnings and balance sheet as follows:

CONSOLIDATED EARNINGS OF GIANT PORTLAND CEMENT CO.

Calendar years—	1931	1930	1929	1928
Net profit after depreciation and taxes	loss *$164,797	$115,133	$ 87,838	$220,321
Bank, etc.; interest, rents, etc	....	18,517	17,205	11,550
Total income	loss $164,797	$133,649	$105,043	$231,871
Deduct—Interest on bonds, etc	....	407	2,160	5,895
Federal income tax for year	....	13,856	10,016	31,565
Loss on dismantling of machinery, etc.	3,306	7,868	8,606	19,540
Net income	loss $168,103	$111,518	$ 84,261	$174,871
Preferred dividends paid	....	(7%)127,979	(7)131,015	(7)130,998
Balance, deficit	$168,103	$ 16,461	$ 46,754	†$ 43,873
Shares of common stock outstanding (par $50)	22,200	22,200	22,081	22,083
Earnings per share on common	Nil	Nil	Nil	$1.99

*After depreciation of $107,264 and loss on dismantling of machinery of $3306. †Surplus.

BALANCE SHEET OF THE GIANT PORTLAND CEMENT CO. AS OF DECEMBER 31

Assets:	1931	1930
Real estate, buildings, machinery, etc.	$2,552,806	$2,660,368
Cash	212,171	329,050
Treasury stock	....	56,362
Chicago Board of Education notes	59,925	59,925
Notes and accounts receivable	15,682	41,034
Loaned on collateral demand notes	100,000	100,000
Sundry debtors	1,879	3,202
Rents and interest receivable	9,615	5,557
Inventories	375,340	378,214
Deferred charges	8,153	8,475
Total	$3,335,571	$3,642,189
Liabilities:	1931	1930
Preferred stock	$1,627,400	$1,880,000
Common stock	1,103,981	1,110,000
Accounts payable	10,806	23,012
Customers' credit balances	715	1,232
Payroll and unclaimed wages	1,203	1,840
Accrued interest and taxes	652	14,821
Reserve for contingencies, etc.	9,000	15,000
Surplus	581,813	596,285
Total	$3,335,571	$3,642,189

Monolith Portland Midwest Co.

THE annual report of the Monolith Portland Midwest Co. and the Laramie Valley Railroad Co., Laramie, Wyo., gives for the year ended December 31, 1931:

ASSETS

Cash, accounts and notes receivable	$ 20,425.42
Inventories	132,969.51
Total current assets	$ 153,394.93
Other assets	26,228.94
Plant and equipment, less reserve for depreciation	2,018,157.25
Limestone deposits	5,008,402.36
Prepaid and organization expenses	576,442.17
	$7,782,625.65

LIABILITIES AND CAPITAL

Current liabilities	$ 42,183.66
Accrued liabilities	9,424.88
Total current liabilities	$ 51,608.54
Liabilities to parent company	365,543.27
Preferred stock outstanding	2,984,910.00
Common stock (stated value)	4,871,230.07
Deficit	490,666.23
	$7,782,625.65

PROFIT AND LOSS STATEMENT

Gross income		$ 417,396.72
Less cost of cement sold		323,380.66
Gross profits		$ 94,016.06
Selling and general expenses		89,250.94
Profit from operations		$ 4,765.12
Deduct:		
Interest charges	$19,280.13	
Depreciation and depletion	72,783.33	
		92,063.46
Net loss		$ 87,298.34

The annual statement of the Monolith Portland Cement Co., Los Angeles, Calif., was published in ROCK PRODUCTS, April 9, p. 54.

New York Trap Rock Corp.

THE New York Trap Rock Corp., New York City, reports its consolidated income for 1931 and its balance sheet as of December 31, 1931, as follows:

CONSOLIDATED INCOME ACCOUNT OF NEW YORK TRAP ROCK CORP., 1931 AND 1930

	1931	1930
Gross operating profit	$2,552,303	$3,324,393
Administrative, selling and general expense	452,834	440,099
Depreciation	523,019	478,045
Depletion	24,713	31,450
Operating income	1,551,738	2,374,799
Other income	64,199	60,264
Total income	1,615,937	2,435,063
Fixed charges	367,333	393,254
Balance	1,248,604	2,041,809
Federal taxes	215,287	297,992
Reserve for bad debts	31,499	39,375
Other charges	62,308	72,722
Minority interest	7,541	11,268
Net income	931,969	1,620,452
Preferred dividends	105,567	140,000
Surplus	$ 826,402	$1,480,452
Earned per share, common	$4.40	$8.22

Number of common shares, 180,000.

CONSOLIDATED BALANCE SHEET OF NEW YORK TRAP ROCK CORP.
(As of December 31)

Assets:	1931	1930
Property and plants	$19,450,012	$19,222,151
Current assets:		
Cash	*1,029,550	1,138,762
Marketable securities	†76,549	13,335
Accounts and notes receivable (net)	1,624,089	1,614,344
Inventories	703,785	668,937
Deposits, etc.	209,783	155,813
‡Reacquired preferred	768,550	....
Deferred charges, etc.	27,714	25,183
Total	$23,890,031	$22,838,525
Liabilities:		
§Preferred stock	$2,000,000	$2,000,000
¶Common stock	5,875,925	5,875,925
Minority interest	104,761	97,220
Funded debt	5,810,500	6,210,500
Current liabilities:		
Reserve for taxes	135,081	244,207
Notes and accounts payable and accruals	692,185	501,224
Reserve for compensation insurance	151,391	129,941
Reserve for depreciation and depletion	2,542,877	2,016,410
‖Capital surplus	322,836	330,336
Earned surplus	6,254,475	5,432,762
Total	$23,890,031	$22,838,525
Current assets	$ 3,433,972	$ 3,435,378
Current liabilities	827,266	745,431
Working capital	$ 2,606,706	$ 2,689,947

*Including $7668 in closed bank. †At market. ‡Consists of 8090 shares at cost. §Represented by 20,000 no par shares. ¶Represented by 180,000 no par shares. ‖Representing appreciation of property taken into accounts in 1918, less capital adjustments.

New Fibre for Gypsum Concrete

PEANUT SHELLS, tested recently as a substitute for wood chips in gypsum-fibre concrete, are reported to have proved a satisfactory substitute.

Traffic and Transportation

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week ending April 30:

TRUNK LINE ASSOCIATION DOCKET

29056. **Agricultural lime,** carloads, minimum weight 30,000 lb. From Milroy and Shraders, Penn., to points in Pennsylvania.

Petersburg	8	Grampian	9½
Williamsburg	8	Hazleton	9½
Bellwood	8	Clifford	7½
Hollidaysburg	9	Kreamer	7½
Roaring Spring	9	Meiser	7½
Martinsburg	9	Middleburg	7½
Henrietta	9	Paxtonville	7
Claysburg	9	Beavertown	7
Sproul	9	Beaver Springs	7
Fishertown	9½	McClure	7
Osterburg	9½	Painterville	6
Bedford	9½	Mt. Joy	9
Osceola Mills	9	Elizabethtown	9
Blue Ball	9		

Rates in cents per 100 lb. (See note 5).

29058. **Crushed stone, coated with oil, tar or asphaltum,** carload (See Note 2), from Tyrone Forge, Penn., to Selinsgrove, Penn., $1.50 per net ton. (Present rate $1.60 per net ton.) Reason—Proposed rate is comparable with rate to Milton, Mammoth and Tranger, Penn.

29071. **Silica rock,** carloads, minimum weight 80,000 lb., from East Buffalo, Buffalo stations, viz., Carroll Street, Louisiana Street, Ohio Street, Erie Street and Black Rock, N. Y., to Harriet and Niagara Falls, N. Y., 76c per gross ton, and from Harriet, N. Y., to Niagara Falls, N. Y., 76c per gross ton. Reason: Proposed rates are comparable with rates on fluxing stone from Buffalo, N. Y., to Niagara Falls, N. Y., and from Gasport, N. Y., to Black Rock, N. Y.

29076. **Crushed stone,** carloads (See Note 2), from Suffern, N. Y., to Warwick, N. Y., $1 per net ton on uncoated stone and $1.10 per net ton on coated stone. (See Note 5.)

29079. **Sand,** N. O. I. B. N., carloads, (A) in open top equipment and (B) in box cars or other closed equipment (See Note 2), from Manumuskin, N. J., to Newport News, Va.: (A) $4.15 and (B) $4.50 per net ton. Reason—Proposed rates are comparable with rates to Alexandria, Richmond and Norfolk, Va.

29083. **Sand, common or building** (not blast, engine, fire, foundry, glass, molding or silica sand), carloads, and **gravel,** carloads (See Note 2), from Charlotte, N. Y.

To points in N. Y.	Prop.	To points in N. Y.	Prop.
Solvay	$1.20	Wolcott	.91
Fairmount	1.20	Red Creek	.91
Camillus	1.20	Sterling	1.10
Martisco	1.20	Crocketts	1.10
West Kendall	.83	Hannibal	1.10
Williamson	.83	Forenbaugh	1.30
East Williamson	.83	Corning	1.30
Sodus	.91	Presho	1.30

29084. **Stone, natural** (other than bituminous asphalt rock), **crushed,** carloads (See Note 2), from Oaks Corners, N. Y., to Millerton, Trowbridge, Jackson Summit, Tioga, Mitchell, Mill Creek, Lambs Creek and Mansfield, Penn., $1.40 per net ton. (See Note 5.)

29085. **Stone, natural** (other than bituminous asphalt rock), **crushed,** carloads (See Note 2). from Tomkins Cove, N. Y., to stations on the West Shore R. R., Erie R. R. and N. Y. O. & W. Ry., West Camp, Kingston, Wallkill, Campbell Hall, Roseton, Highland Falls, New Windsor, Central Valley, Tuxedo, Greycourt, Firthcliffe, Middletown, Napanoch, Cottekill, Oakland, Monticello, Liberty, Cooks Falls, N. Y., and various. Rates ranging from 60c to $1.50 per net ton. (See Note 5.)

29086. **Stone, natural** (other than bituminous asphalt rock), **crushed,** carloads (See Note 2), from Oaks Corners, N. Y., to Fassett, Gillett, Dunning, Snediker, Columbia X Roads, Tin Bridge, Troy, Cowley, Alba, Canton, Cedar Ledge, Grover and Leolyn, Penn., $1.50 per net ton. (See Note 5.)

29087. **Sand,** carloads (See Note 2), from P. R. R. stations, viz.: McDonoughs to Milltown, N. J., to Montreal (Place Viger) to Atwater, Que., $4.80 per net ton. (Present rate—$4.79 per net ton.) Reason: Proposed rate is comparable with rate from South Amboy, N. J.

29089. **Crushed stone, coated with oil, tar or asphaltum,** carloads (See Note 2), from Monocacy, Penn., to Soudan, Va., $4.25 per net ton. (Present rate, 32c per 100 lb., Class D.) (See Note 2.)

29091. To cancel from P. R. R. G. O. I. C. C. 13804 rate of $2.90 per net ton on **sand and gravel** from Masonville and Hainesport, N. J., to Port Chester, N. Y. Reason: Investigation develops no traffic has moved for some time nor is there prospects for future shipments, therefore rates are obsolete.

29095. **Limestone** (finely ground), carloads, minimum weight 50,000 lb., from Annville, Penn., to Plainsboro, N. J., 12½c per 100 lb. Reason: Proposed rate is comparable with rates to Newark, N. J.

28559. **Sand blast, engine, foundry, molding, glass, silica, quartz or silex,** carloads (See Note 2), from Berkeley Springs District, Penn., to Barking, Penn., $1.95, and Clarksville, Penn., $2.10, and from Triplett-Gore, Va., to Barking, Penn., $2.10, and Clarksville, Penn., $2.25 per net ton.

29100. **Crushed stone, carloads** (See Note 2), from White Haven, Penn., to Oakbur Junction, Penn., 70c per net ton. Present rate, $1.05 per net ton. Reason—Proposed rate is same as Lycoming Scale.

29107. **Stone, natural** (other than bituminous asphalt rock), **crushed,** carloads (See Note 2), from Oaks Corners, N. Y., to Rexford, Manhattan, Galeton, Kilbourne, Talescope, Walton, Brookland, Newfield Junction, Newfield, Pusher Siding, West Bingham and Hickox, Penn., $1.50 per net ton. (See Note 5.)

Note 1—Minimum weight marked capacity of car.

Note 2—Minimum weight 90% of marked capacity of car.

Note 3—Minimum weight 90% of marked capacity of car, except that when car is loaded to visible capacity the actual weight will apply.

Note 4—Reason—To meet motor truck competition.

Note 5—Reason—Proposed rates are comparable with rates on like commodities for like distances, services and conditions.

CENTRAL FREIGHT ASSOCIATION DOCKET

31286. To establish on **sand,** except blast, core, engine, filter, fire or foundry, glass, grinding or polishing loam, molding or silica and **gravel** (except as noted), carloads, from South Lorain, O., to Wellington, O., rate of 70c per net ton. Present, 80c.

31294. To establish on **crushed stone, crushed stone screenings and agricultural limestone** (not ground or pulverized), in bulk, in open top cars, carloads, from Narlo, O., to Titusville, Centerville and Spartansburg, Penn., rate of 190c per net ton. Present—Classification basis.

31295. To establish on sand, viz., lake, river and bank, carloads, actual weight will apply, from Gary, Ind., to Willow Creek, Ind., rate of 50c per net ton, to apply only on traffic destined to points on Michigan Central R. R. Route: Via Wabash Ry.

31297. To establish on **sand** (other than blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica) or **gravel,** carloads, from Oil City, Penn., to Bear Lake, Lottsville, Columbus, 100c; Corry, Union City, Mill Village, Millers, Cambridge Springs, Venango and Saegertown, Penn., 80c per net ton. Present—Sixth class.

31298. To establish on **sand and gravel,** carloads, from Akron, O., to Wick, O., rate of 100c per net ton. Present—15c (6th class).

31299. To establish on **slag, crude, granulated, crushed or commercial** (the product of iron and steel furnaces), in bulk, in open top equipment, in straight or mixed carloads, from Hamilton, O., to Benton Harbor, Mich., 265c per net ton. Route—P. R. R., La Crosse, Ind., P. M. Ry. Present—23c (Classification basis).

31351. To cancel rate of 60c per net ton on **stone, crushed,** carloads,, from Neffs, O., to St. Clairsville, O., published in B. & O. R. R.-Eastern Lines' Freight Tariff 1935, Ohio No. 5540, account obsolete.

31357. To establish on **crushed stone,** in open top cars, carloads, from Milltown and Marengo, Ind., to Petersburg, Ind., rate of 90c per net ton. Present, 103c.

31358. To establish on **gravel and sand,** carloads, from Green Oak, Mich., to Toledo, O., rate of 67c per net ton. Present, 70c.

31365. To establish on **crushed limestone,** carloads, from Calcite, Mich., to Paulding, 190c, and to Ottawa, O., 265c per net ton. Present, 250c to Paulding and 294c per net ton to Ottawa, O. Route, via D. & M. Ry.

31172. To establish on **agricultural limestone, crushed stone screenings, stone tailings, stone, quarry scrap and stone, rip rap,** in bulk in open cars, from Greencastle, Limedale, Ind., to Maroa, Ill., rate of 88c per net ton, via P. R. R. direct. Present, 101c.

31174. To establish on **agricultural limestone,** carloads, minimum weight 50,000 lb., from Piqua, O., to Wheeling, Moundsville, New Martinsville, Bens Run, Parkersburg, Ravenswood, Point Pleasant, Apple Grove, Huntington and Kenova, W. Va., rate of 202c per net ton. Present—227c to Wheeling, Moundsville, New Martinsville; 214c to Parkersburg, Ravenswood; 227c to Point Pleasant, Apple Grove; 214c to Huntington and Kenova, W. Va.

31175. To establish on **crushed stone, crushed stone screenings and agricultural limestone** (not ground or pulverized), in bulk, in open top cars, carloads, to points in Indiana.

To	From Delphos, O. Pres.	Prop.	From Bluffton, Ind. Pres.	Prop.
Ft. Wayne	*75c	75c	......	......
Dawkins	......	......	80c	70c
Edgerton	85c	75c	80c	70c

*P. R. R. I. C. C. No. 135; rate, 85c at present via N. Y. C. & St. L. R. R. intermediate to Kingsland, Ind.

31176. To establish on **agricultural limestone, crushed stone, stone screenings,** in straight or mixed carloads, in open top cars, from Greencastle and Limedale, Ind., to Stewardson, Shumway and Blue Point, Ill., rate of 115c per net ton, emergency charge of 6c in addition. Present—126c per net ton, emergency charge of 6c in addition.

31178. To establish on **sand,** all kinds, carloads, from Vigo and West Junction, O., to Chillicothe, O., rate of 60c per net ton, subject to emergency charges. Present—80c. Route—Via B. & O. R. R. direct.

31179. To establish on **stone, crushed,** in bulk, in open top cars; **limestone, unburned, agricultural,** in open top cars, carloads, from Middlepoint, O., to New Bremen, O., rate of 85c per net ton (does not include emergency charge). Route—Via P. R. R., Lima, O., N. Y. C. S&t. L. R. R. Present —90c per net ton.

31182. To establish on **foundry sand,** carloads, to Detroit, Mich., from Oak Shade, O., 100c, and Carleton, Mich., 70c per net ton, plus emergency charge. Present—15c from Oak Shade, O., and 10c, Carleton, Mich. (sixth class), per C. F. A. L. Tariffs 487 and 481.

31185. To establish on **sand and gravel,** in straight or mixed carloads.

To Representative L. & N. R. R. Kentucky Stations, Kentucky Division

	From Miami, O.	From Wil-leys, O.		From Miami, O.	From Wil-leys, O.
Rosedale	80	80	Lynn	100	100
Ryland	85	85	Falmouth	100	100
Morning View	90	95	Morgan	110	110
Demossville	95	95	Poindexter	120	120

To Representative L. & N. R. R. Stations, Cincinnati Division

	From Miami, O.	From Wil-leys, O.		From Miami, O.	From Wil-leys, O.
Maurice	80	80	Sparta	110	110
Bank Lick	85	85	Worthville	110	110
Walton	90	90	Turners	120	120
Zion	100	100			

(Rates in cents per net ton.)

Note—Subject to Agent Speiden's Tariff of Emergency Charges (I. C. C. 1616).

Route—Via C. & O. Ry., Cincinnati, O., L. & N. R. R.

Present—Combination basis.

31207. To establish on **crushed stone, crushed stone screenings and agricultural limestone** (not

ground or pulverized), in bulk, in open top cars, carload, from Lima, O., to Mt. Cory, O., rate of 60c per net ton, subject to emergency tariff. Route —Via N. Y. C. & St. L. R. R. direct. Present—70c, subject to emergency tariff.

31208. To establish on **stone, crushed, coated with oil, tar or asphaltum**, carloads, from Sandusky, O., to Akron, 114c; Canton, 122c; Greenwich, 91c; Mansfield, 99c; Mt. Vernon, 114c; Shelby, 91c; Tiffin, 87c; Youngstown, 129c; Zanesville, O., 137c per net ton. Present—To Akron, 142c; Canton, 153c; Greenwich, Mansfield, 119c; Mt. Vernon, 142c; Shelby, 119c; Tiffin, 107c; Youngstown, 176c; Zanesville, 176c per net ton.

31211. To establish on **pulverized limestone**, carloads, minimum weight 60,000 lb., from Superior, O., to points in C. F. A. territory, rates on basis of 60% of the current sixth class. Present—Sixth class.

SOUTHWESTERN FREIGHT BUREAU DOCKET

24638. **Sand (river) and gravel**, from Pacific, Mo., to Mobile, Ala. To establish rate of $3.22 per ton of 2000 lb. on sand (river) and gravel, carloads (See Note 3), from Pacific, Mo., to Mobile, Ala. The proposed rate reflects the East St. Louis, Ill., combination based on 77c to East St. Louis, per St. L.-S. F. Tariff 1298-I, plus 245c beyond per Glenn's 88-A. It is desired to apply this combination via St. L.-S. F., Aliceville, Ala., and A. T. & N. R. R.

24651. **Sand, gravel, crushed stone, etc.**, from and to stations in Arkansas, Kansas, Louisiana, Oklahoma, Missouri and Texas, Memphis, Natchez and Vicksburg. To amend S. W. L. Tariff 162-D, applying on sand, gravel, crushed stone, etc., from and to stations in Arkansas, Kansas, Louisiana, Oklahoma, Missouri and Texas, Memphis, Natchez and Vicksburg, as provided in Items 100 to 120 of Tariff 162-D, by extending the application of Bases Nos. 30, 31 and 32 beyond 800 mi. to 1000 mi. at rate of progression of 10c per ton for each additional 30 mi. or fraction thereof, subject to the silica sand rates (Bases Nos. 20, 21 and 22, respectively), as maxima. There is a contemplated movement of limestone from southeast Missouri to Texas for distances over 800 mi. It is proposed to extend the scale to include 1000 mi. at the same rate of progression that prevails for distances over 200 mi. But since the silica sand (in box cars) rates for over 980 to 1000 mi. are less than the common sand, etc., rates at this progression, it is proposed to observe the silica sand rates as maxima

ILLINOIS FREIGHT ASSOCIATION DOCKET

136-A. To cancel commodity rate of $1.14 per net ton on **slag**, carloads, from Joliet, Ill., to La Salle, Ill., allowing classification basis to apply in lieu thereof account no movement.

3543-H. **Sand**, carloads (See Note 1), from East St. Louis, Ill., to points in Illinois. Rates per net ton.

To	Pres.	Prop.	To	Pres.	Prop.
Johnston City	*	$0.95	Farina	*	1.23
Jeffries	*	.95	Kinmundy	*	1.23
Edgewood	*	1.23	Alma	*	1.23
Laclede	*	1.23	Odin	*	1.10

*Distance rates.

6592. **Crushed stone, sand and gravel** (See Note 3), but not less than 40,000 lb., from Alton, Ill., to representative points in Missouri.

To	Pres.	Prop.	To	Pres.	Prop.
Machens	*	70	Old Monroe	*	88
White Corn	*	76	Foley	*	94
Dardanelle	*	82			

*Various.

6605. **Crude silica sand** in open top cars (See Note 3), but not less than 40,000 lb., from Ottawa-Utica, Ill., to Carbon Cliff, Silvis, East Moline, Moline, Ill., and Davenport and Linwood, Ia. Rates per net ton. Present, $1.13; proposed, $1.01.

WESTERN TRUNK LINE DOCKET

Sup. 1 to 2292-I. **Stone, crushed**, carloads (See note 3), but in no case shall the minimum weight be less than 40,000 lb., from Ely, Minn., to Chicago, Ill. Please refer to Docket Bulletin No. 3123, dated January 27, 1932, Docket 2292-I. This subject has now been canceled from the docket.

Supp. 1 to 6025-F. Rates and minimum weights —**Limestone, crushed or ground**, carloads, from Stolle, Ill., to representative points in Kansas as shown below. Rates—Present, Class or combination. Proposed:

	8% of 1st class	Prop.		8% of 1st class	Prop.
Kanorado	20	20	Burr Oak	17	17
Cedarvale	15	15	Arcadia	13	13

Minimum weight—Present various—Proposed (See Note 3).

7945. Rates, **limestone, agricultural**, less carloads, in barrels or boxes, or in bulk in bags, barrels or boxes, between points in W. T. L. territory. Rates, present, classification basis; proposed, to include in Item 1290, W. T. L. Tariff 207-B and similar items now applicable to phosphate, acidulated, or phosphate, acidulated and ammoniated, thereby applying 1½ times Class E.

Proposed I. C. C. Decisions

22020. Truck Competition on Cement. A flat recommendation that the Interstate Commerce Commission reverse itself on account of truck competition has been made by Examiner Johnston in No. 22020, Iola Cement Mills Traffic Association et al. vs. A. T. & S. F. et al. The proposal is made after further hearing, the prior report being in 172 I. C. C. 684. The finding, Commissioner Johnston said, that should be reversed was that the rates on cement from Portland and Boettcher, Colo., and Laramie, Wyo., to destinations in Colorado and Wyoming were unduly preferential of shippers at those points and unduly prejudicial to shippers at Dewey, Okla., and Chanute, Humboldt, Fredonia, Iola, Independence and Mildred, Kan., to the same destinations. The reversal proposed is to cover the finding as to what would be the just and reasonable rates on intrastate cement traffic in Colorado and Wyoming.

Complainants are cement manufacturers in the so-called Kansas gas belt. The prior report found that the rates from Portland, Boettcher and Laramie gave the shippers at those points an undue preference to the extent they were less than rates based on the average of cement scales III and IV, prescribed in Western Cement Rates, 48 I. C.C. 201, 69 I.C.C. 644, for use on intrastate traffic in Colorado and Wyoming, provided that the rate from Laramie to Denver was made the same as the rate from Portland.

The controversy, Commissioner Johnston said, was that the gas belt mills shipped on the basis prescribed as reasonable, while the mills at Portland and Boettcher might ship intrastate and the mill at Laramie might ship, interstate, to destinations in Colorado at rates substantially lower than the interstate rates fixed by the Commission a reasonable maxima for the respective differences in this territory. The mills at Portland, Boettcher and Laramie intervened in the case to protect their interests. Both railroads and interveners objected, Commissioner Johnston said, to any increase from Portland, Boettcher and Laramie, contending that the present rates were necessary to meet truck competition and to retain the traffic to the rails. Commissioner Johnston said it was generally known that truck rates were not made on any uniform basis but were designed to meet competition as it existed. Interveners said that if the rates were increased they would have to resort to truck transportation. Commissioner Johnston included in his report much testimony about truck rates and the methods used in calculating delivered prices of cement.

Postpones Action on Gravel Rates

IN ANNOUNCING the May docket of the Mississippi state railroad commission, Secretary Williamson said that the petition before the body for a rehearing on sand and gravel rates, fixed by the commission last December, would not be disposed of until after the regular meeting May 3.

The commission recently concluded hearings on proposed reopening of the rate question, an issue between the carriers and gravel pit operators, who sought to reopen the case. Stenographers were given until May 7 to complete transcript of the hearings, after which date for further hearings, if any are deemed necessary, will be set and a decision handed down, Mr. Williamson announced.—*Columbus* (Miss.) *Dispatch.*

Protest Intrastate Limestone Rates in Virginia

THE American Limestone Co., of Knoxville, Tenn., has filed with the Interstate Commerce Commission a complaint against rates on limestone intrastate in Virginia, claiming that the rates between Virginia points should be no higher than the rates between Mascot, Tenn., and Virginia points.

The complaint was scheduled for hearing in Washington May 4.

Virginia has very low rates on limestone within the state, since the product is used in agriculture and is sold at a price so low that the freight rates figure largely in its cost to the farmers.

The state operates two crushing plants, which prepare the limestone for sale at cost. —*Richmond* (Va.) *News-Leader.*

Public Works Study Is Sought in Congress

REPRESENTATIVE FISH (Republican) of Garrison, N. Y., introduced a resolution (H. Res. 208) April 30 for creation of special House committee on public works to recommend a two-year plan for emergency construction to aid employment. His resolution follows in full text:

"Resolved, that the Speaker of the House of Representatives is hereby authorized to appoint a special committee of five members of the House, whose duty it shall be to immediately survey needed public works, such as post office and other Federal buildings, construction and maintenance of highways, and improvement of rivers and harbors and Federal projects that will not create further overproduction of basic commodities, with authority to report to the House at any time with recommendation for a two-year plan for emergency construction of public works throughout the United States to relieve unemployment.

"Said committee shall submit an estimate of the cost of each project contained in its recommendations, an estimate of the number of workmen to be employed on each project, and the ways and means of financing the projects recommended in its report.

"Resolved further, that the special committee shall have the power to investigate the advantages of the 40-hour workweek, or fewer hours of labor per day on public works, and recommend a definite plan to relieve the present distressing economic conditions by providing for the employment of a maximum number of unemployed American workmen of Federal works."

Foreign Abstracts and Patent Review

High Grade Cement and Natural Cement. Otto Gassner discusses the questions of "What is understood to be high grade cement?" and "Is the designation *high grade natural-cement admissible?*" The German courts base their decisions in the controversy on the trade views of cement consumers, in which the following specifications for the construction of buildings of reinforced concrete had an influence: "of high grade cements (specification cements, alumina cements) are . . ." Viewed independently, the designation "high grade cement" is an abbreviation of "cement with high initial strength," the term which was originally used. Since word and sense do not agree, translations to foreign languages result in circumscriptions (for example, "early high strength cement"). Gruen calls them "high strength" cements. In Austria they are designated as "early high strength."

That the high valence is exhausted with the high initial strength (the alumina cements may be entirely eliminated from consideration here) is apparent from the wording of the proposal for German specification cements and blast furnace cement: the high-grade portland, iron portland and blast furnace cement is distinguished, as compared to portland, iron portland and blast furnace cement, primarily through its high initial strength. The author gives this example of distinction: The Merkur cement is a natural cement; the high-grade Merkur cement is a natural cement with high initial strength. There should be no need for explanations between "Merkur cement with high initial strength"' and "Merkur cement is an early high strength natural cement."

The author discusses the industry of the Westphalian natural cement plants and states that the difference between portland cement and natural cement lies, briefly stated, only in the burn of ground or lump material, or in the use of artificially mixed or naturally available materials. Specifications for portland cement should be so worded that the definition includes at the same time artificial portland cements and natural portland cements, whenever the latter comes up to the former in quality, as is found in Austrian, Swedish, Czecho-Slovakian, Italian and other specifications. The Austrian specification states "portland cement is obtained from natural lime marl or artificial mixtures of alumina and lime-bearing materials by burning to a sinter and a consequent pulverization to the fineness of grinding."

Germany has no specifications for natural cement, since the Westphalian portland cement industry has been developed only since 1925. Efforts are, however, made to adopt specifications, the following being part of the proposed specifications: "The natural cement being made by the members of the Association of Cement Plants in Westphalia is a hydraulic binding agent made by burning at least to sintering, and fine grinding, of a raw material having not less than 1.7 parts of lime (CaO) per 1 part soluble silicic acid (SiO_2), by weight, plus alumina (Al_2O_3) plus ferric oxide (Fe_2O_3). The magnesia content must not be more than 5%, the content of sulphuric acid anhydride not more than 2½% in the calcined cement. Additives for special purposes, as for example, for advancing the time of set, are limited all told to 8% of the total weight, to exclude the possibility of additives merely for increasing weight." The author refers to the dangers to the portland cement industry in this definition. Under present conditions natural cements in Germany cannot be designated as portland cements nor as natural portland cements or nature-portland cements. The entire subject is not a problem of materials, but is a problem of the preparation of materials.—*Beton u. Eisen* (1931) **30**, 8, pp. 149-152.

Hydraulic Limes. P. Feron discusses perfections in manufacture of hydraulic limes and their possible future. Experiments have been made for some time with different deposits of limestone of very different chemical composition and of sometimes very heterogenous physical texture to determine the results of overburning and overslaking in the production of limes. It is possible to obtain by overburning and overslaking with most limestones for hydraulic limes, strengths 4 to 5 times higher than the normal strengths of 2 to 4 kg., which are obtained ordinarily in tests with 1:3 plastic mortars after 7 days. When the chemical composition and the physical texture of the limestone are suitable, and favorable to the formation of the compounds which furnish the strengths, one can obtain strengths exceeding 20 kg. after 7 days, already in 1:3 plastic mortar. Strengths of 14 to 15 kg. have been obtained after 2 days on high hydraulic limes from good limestone. The strengths and chemical compositions of some different hydraulic limes are as follows:

CHARACTERISTICS OF THREE SUPERIOR PRODUCTS

	Product designated as A	B	C
Silica	20.40	16.50	21.00
Iron	2.90	1.60	1.80
Alumina	3.70	2.30	3.50
Lime	65.20	66.10	64.20
Magnesia	1.20	1.30	0.80
Sulphuric anhydride	0.80	1.50	1.20
Loss on ignition	5.50	9.80	6.20
Tensile strength of 1:3 plastic mortar in kg. per. sq. cm.:			
4 days	10	21	20
7 days	23.6	25.7	27
28 days	30	31	34

Their hydraulic indices correspond little to moderate hydraulic limes, but their strengths are those of good cements. They have a very low silica content and much more iron alumina if the relation $SO_2 : Al_2O_3 + Fe_2O_3$ is considered. But in three other types of products the relation is much greater and the content in SiO_2 high; the strengths given by these products are remarkable:

CHARACTERISTICS OF SOME HYDRAULIC LIMES

	A	B	C
Silica	14.30	17.50	15.00
Iron and alumina	8.50	8.20	8.50
Lime	66.80	65.80	66.20
Magnesia	0.50	traces	0.40
Sulphuric anhydride	0.70	0.80	0.60
Loss on ignition	8.90	7.70	9.20
Tensile strength of mortar in kg. per sq. cm. after			
7 days	18	19	20
28 days	24	26	27

A characteristic of these superior products is an occasional low density, which may decrease to 0.750. But this is the one new quality and of appreciable advantage for its use; for, the mixture being equal, a mortar can be obtained which is more fat, more compact and more impermeable for a suitable granulometric composition of sands used. By the new method even a lime giving normally a strength of 1.2 to 1.5 kg. after 4 days has been found to increase its strength to 6 to 8 kg. after 7 days, using 1:3 plastic mortar.—*Revue des Materiaux de Construction et de Travaux Publics* (1931) 263, pp. 309-310.

Concluding Remarks on Alit. A. Guttmann and F. Gille review the conclusions of controversies relative to the alit problem, and then present in two tables the results they have obtained in a recent x-rayographic and optical examination of several grades of cement clinker and of a celit. Upon the basis of these data and former researches on alit, the authors make the following final conclusion: There is no longer any doubt as to the existence of the compound $3CaO \cdot SiO_2$. Alit, the principal constituent of portland cements fat in lime, is neither a bicalcium silicate (Dyckerhoff) fattened with lime, nor a mixed crystal of aluminate or Janeckeit fat in lime and of tricalcium silicate (Kuehl), nor a mixed crystal of predominantly tricalcium silicate with tricalcium aluminate (Guttmann and Gille), nor a mixed crystal of Jaeneckeit and bicalcium silicate (Jaenecke), nor is the bicalcium silicate a carrier of the alit (Nacken); but alit is tricalcium silicate. A portion of the alumina is fixed in celit (essentially $4CaO \cdot Al_2O_3 [Fe, Mn]_2O_3$); the portion which is present above this amount appears in the clinker as free aluminate ($3CaO \cdot Al_2O_3$, in part also $5CaO \cdot Al_2O_3$).

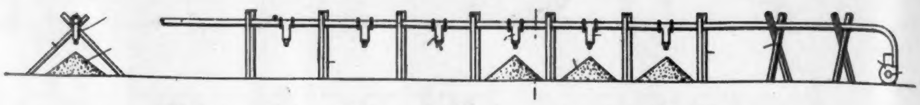
The history of the alit problem is reviewed as follows: Le Chatelier was the first one who, upon the basis of analysis of Grappiers, represented the opinion that

$3CaO \cdot SiO_2$ is the principal carrier of the hydraulic hardening in portland cement; however, he did not succeed in presenting this pure compound. Rankin and Wright were the first to prove the existence of this compound and maintain its occurrence, besides β $2CaO \cdot SiO_2$, in cements. By means of microscopic examinations of clinker from the market and test burns, P. H. Bates has shown its existence in cement probable. W. Dyckerhoff verified the compound $3CaO \cdot SiO_2$, but did not recognize it as the principal carrier of the hardening in portland cement. W. C. Hansen and Brownmiller made known for the first time x-rayograms of pure $3CaO \cdot SiO_2$ and showed that $3CaO \cdot SiO_2$ could be clearly proved x-rayographically in clinker burned at 1360 deg. C. I. Weyer determined that tricalcium silicate in kaolin-lime mixtures starts to form at 1300 deg. C. He determined also for the first time exact optical values for pure tricalcium silicate. By a possibly complete separation of the alit from the technical clinker and its x-rayographic, optical and chemical examination, Guttmann and Gille finally carried the direct proof that this alit is tricalcium silicate. The problem of what is alit has thus been brought to a conclusion after 50 years of research. But there are other new and important problems, as for example: What is the atomic arrangement in alit, and how does the hardening process take place?—*Zement* (1931) **20**, 7, pp. 144-147.

Recent Process Patents

The following brief abstracts are of current process patents issued by the U. S. Patent Office, Washington, D. C. Complete copies may be obtained by sending 10c to the Commissioner of Patents, Washington, D. C., for each patent desired.

Process for the Decomposition of Crude Phosphate. It has already been tried to treat phosphate rock with potassium sulphate and an acid, as nitric acid, in the place of sulphuric acid. But this resulted in loss of potash due to the formation of double sulphates of potassium and lime. This patent is for a method of recovering the potassium in the double salt, by washing the gypsum slime, which contains it, first with water and nitric acid and afterward with clear water. A second claim covers the re-use of the wash solution which contains nitric acid.—*Theodor Throssell and August Kristensson, Germany, U. S. Patent* 1,810,858.



Valve outlets at intervals discharge to ground storage

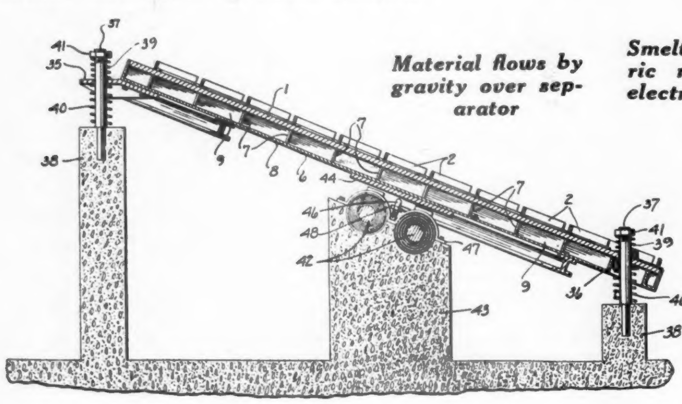
Hydraulic Conveyor. The inventor describes a hydraulic conveyor for handling sand, silt or other materials suspended in a liquid. He proposes to deliver sand, in a water suspension, through a pipe with valve outlets at intervals so that the sands can discharge to ground storage below. The author of the process proposes to use the method for building roads through swampy regions, levee construction and similar uses. *William C. Whitcomb, U. S. Patent No.* 1,760,616.

Production of Calcium-Aluminate Cements and Fertilizer Materials. Phosphate rock and a material containing alumina are fused together in a shaft furnace or a rotary kiln at temperatures from 1200-1600 deg. C. The phosphorous is volatilized and may be recovered as such or it may be oxidized and recovered as phosphoric acid. The slag left is a calcium aluminate cement. The inventor prefers to use one part of phosphate rock and two parts of alunite, heating in the presence of carbon. The reaction is such that the alumina of the alunite combines with the lime of the phosphate rock and the other constituents of the charge, including the potash of the alunite, are volatilized and may be recovered by known methods.—*Herbert H. Meyers, Assignor to Armour Fertilizer Works, Chicago, U. S. Patent* 1,778,224.

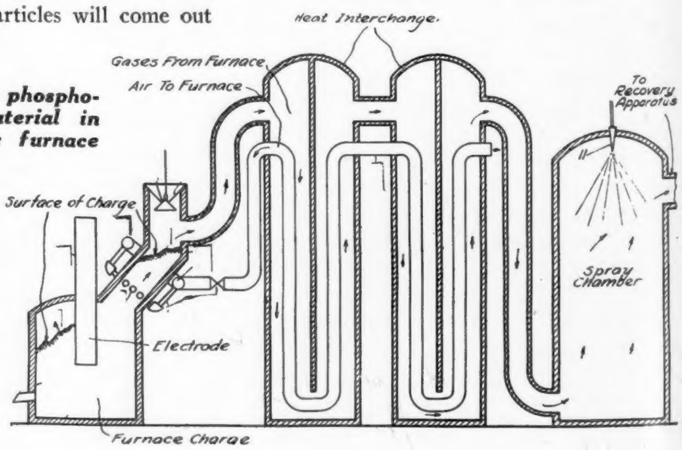
Separating Intermixed Materials. The device shown is a dry concentrator. It has an inclined table supported on springs and vibrated by electro-magnets over which the material to be treated flows by gravity. The top of the table is of cloth or other pervious material and air which is blown into cells below the table top rises through it. On top of the table are riffles which aid in the separation. The principle is that used by all concentrating tables, the lighter particles of the feed traveling farther and faster than the heavy particles. As the table slants to one side as well as in the direction of its length, the lighter particles will come out along the riffles toward the bottom of the table and the heavy particles will come out on riffles nearer the upper end. The inventor says the device is especially designed to remove bone and slate from coal, although it may be used for other minerals.—*Kenneth Davis, Assignor to Peale Davis Co., U. S. Patent* 1,782,391.

Process for Forming Grayish-Black Slate Granules. This is especially adapted to coloring green slate granules, but it may be applied to slate of other colors. The preferred formula for the coloring solution is 15 g. ferrous sulphate, 15 g. sodium dichromate, 50 g. copper sulphate and 500 cc. water. The slate is soaked in this and then heated and agitated at a temperature estimated by the inventor to be 1800 deg. F. for ten minutes. He ascribes the warm black color produced to be due to the copper oxide formed. Various modifications of the color may be obtained by changing the formula and by using oxidizing or reducing atmospheres.—*Harry C. Fisher, Assignor to the Phillip Carey Manufacturing Co., U. S. Patent* 1,782,649.

Smelting Phosphoric Material in Electric Furnace. The inventor describes his method of smelting phosphoric material in an electric furnace producing phosphoric acid and calcium carbide. He proposes to use a carbonaceous reducing agent in sufficient quantity to produce elemental phosphorus and also to combine some of the carbon with the lime and produce calcium carbide. He describes in the process a method of producing phosphoric acid and calcium carbide at one operation, the steps of which comprise providing a descending furnace charge of phosphate rock and coke, smelting the charge in the bottom of the furnace while excluding air from the smelting zone. He then passes the evolved gases through the upper part of the charge, introducing preheated air into the upper part of the charge above the smelting zone and partly oxidizes the evolved gases. *Warren R. Seyfried, assignor to Swann Research, Inc., U. S. Patent No.* 1,777,582.



Material flows by gravity over separator



Smelts phosphoric material in electric furnace

Asks for State to Support Established Producers

A PLEA for state support in preserving the gravel and stone industry in Indiana, made by representatives of the industry at a state highway commission meeting attended by Governor Leslie, was being considered recently by the commissioners.

Representatives of stone and gravel companies, aided by railroad representatives, protested against the awarding of contracts to firms not permanently established. The commission was asked to adopt a policy of not awarding contracts to firms that were not in operation before the bids were let.

C. Dolly Gray, chief spokesman for gravel interests, told the commissioners that the industry has a $15,000,000 investment in Indiana and employs 15,000 persons. It virtually depends for existence, Mr. Gray said, upon state highway work.—*Michigan City* (Ind.) *Dispatch.*

Oppose Purchase of Quarry by County

PROTEST was offered recently by over 20 residents and taxpayers of the town of Herkimer, N. Y., against the purchasing of a stone quarry for the county by the county board of supervisors.

An informal meeting of the taxpayers was held with the town's representatives prior to the call of the meeting. It is reported that the taxpayers were opposed to having the county enter into the purchase of the Newport Stone Quarries.

A communication was received from Homer J. Dunn stating that he would offer a farm of 70 acres, containing a stone quarry, to the county for $10,000. It is located at Newport, 12 mi. from Herkimer. He gave a price of $5000 for the quarry. This was filed.—*Utica* (N. Y.) *Press.*

Investigate Deposit of Gypsum

THE HAMLET of Valley Mills, southeast of Oneida, N. Y., is anticipating the contemplated reopening of a quarry which for several years has lain dormant, following the reported discovery of a formation of gypsum rock.

Although little is known of the men who are behind the movement, it is known a group has been at work at the quarry a fortnight making examinations and experiments with the rock. The men have concealed plans for development.

The deposit has not been worked for years, although farmers of the vicinity remember when land plaster was produced there.

The men who have become interested in the quarry now and who have characterized it as gypsum rock seem assured it possesses the qualities for building material.—*Syracuse* (N. Y.) *Post-Standard.*

Colonel E. M. Young

ON APRIL 26 Col. E. M. Young, president, Lehigh Portland Cement Co., died at his home in Allentown, Penn., following several months illness. Col. Young has had an important part in the development and promotion of the portland cement industry.

In 1897, with Gen. H. C. Trexler, he organized the Lehigh Portland Cement Co. and became secretary-treasurer. In 1908, Col. Young was made a vice-president and in 1925 was elected president, which office he had held since. His name appears conspicuously on the roster of the board of directors from 1897 to the time of his death, with an uninterrupted service record of 35 years, during which period he missed few meetings of the board.

Col. E. M. Young

Col. Young's genius was largely responsible for the remarkable strides made by his company. He saw it grow from an unpretentious office in Allentown and a small cement mill at Ormrod, a few miles distant, to a chain of 20 mills reaching from the Hudson westward to Washington state and southward to the Gulf, with offices in 25 principal cities. He was regarded everywhere as a leader gifted with stability and energy far beyond the limits of most men. He was also a director of the Canada Cement Co., Ltd., operating 11 cement mills.

Col. Young had been an earnest worker in the Portland Cement Association. His name, with that of the Lehigh company, was first on the document calling a meeting of portland cement manufacturers in 1902 which resulted in formation of the Portland Cement Association. He was the first treasurer of the association, was the secretary in 1903, and served as director from 1904 to 1909 and from 1913 until his death. He also served as treasurer in 1922.

As a member of the executive committee and many important working committes at various times, Col. Young enjoyed a unique distinction. Few men were as well known among the cement executives or as welcome on all occasions. He was an excellent story teller and dispensed wit and humor at many a meeting and dinner. He was in demand as a toastmaster and served the association and other bodies occasionally in that capacity.

Col. Young had a pardonable pride in the Lehigh company and its achievements. The leadership of his employes in many lines of activity gave him keen delight. Success attained by the Lehigh organization in accident prevention work was one of his hobbies and he constantly encouraged it.

In addition to his cement affiliations, Col. Young found time to serve his neighbors and fellow citizens in many important capacities. He had been a member of the republican state committee of Pennsylvania for years and frequently served as national delegate as had his father and grandfather before him. He served on the staffs of several governors and with the state militia. He was also actively interested in various commercial and industrial enterprises.

He was born in Allentown and was in his 67th year. His widow, two sons, Robert Young and Joseph Young, and a daughter, Mrs. Edward Durham, survive him.

Recent Prices Bid and Contracts Awarded

Maquoketa, Ia. Charles Pape of Dubuque was awarded contract for surfacing roads in Jackson county recently. His bid was $1.17 per cu. yd. for 11,760 yd. of class A crushed rock.

Newton, N. J. Contract for 6000 tons of limestone screenings has been awarded by the Sussex Board of Freeholders at $2.04 per ton to the Limestone Products Corp. Gallo Bros. have been awarded contract for 2000 tons of 2½-in. stone at $1.60 per ton and 1000 tons of ¾-in. stone at the same price.

Memphis, Tenn. Four firms, with identical bids of $2.31 per ton, will divide the contract for crushed stone for city requirements.

Valparaiso, Ind. LaPorte county commissioners have awarded Dolese and Shephard, Chicago, Ill., contract for crushed stone on its bid of $1.44 per ton for stone and $1.25 for screenings.

Galesburg, Ill. Contract for graveling the roadway along the southern banks of Lake Storey were recently let by the city council to the Fredricks Sand and Gravel Co. at $1.35 per ton.

Wisconsin Increases Award to Manitowoc Portland Cement Company

THE WISCONSIN State Highway Commission has announced that the controversy over the price of cement for the 1932 highway program has been adjusted in such a manner that the Manitowoc Portland Cement Co., Manitowoc, Wis., will furnish 600,000 bbl. at a reduction of about 13c. a bbl. from its former contract price.

"The new arrangement will permit the Manitowoc mill to operate at full capacity during the season and enable it to employ its regular force of 160 men," the commission said.

The controversy was brought about by lower bids offered to Illinois than were made in Wisconsin last November. The commission at that time contracted for 1,250,000 bbl., but recently announced that the contracts would not be fulfilled except at the lower Illinois price [as was reported in the April 23 issue of ROCK PRODUCTS].

The Manitowoc company protested it could not meet the reduced price and operate its plant. In the adjustment, however, its contract was increased from 425,000 to 600,000 bbl. and the company agreed to forego a freight differential of 13c. a bbl.

The commission originally awarded contracts to ten companies in the middle west. Only three of these, Manitowoc, Alpha and Marquette, agreed to reduce the price. So they will furnish all the cement.

Marquette will furnish about 487,000 bbl. and Alpha 62,500.

By this arrangement the state will supply all the cement for the 1932 highway projects and will not put into effect the plan to have contractors do their own cement buying.

The commission's announcement was accompanied by a lengthy statement. It said in part:

"The highway commission acted in good faith by advertising for bids on cement late in 1931, that the Manitowoc mill might operate throughout the winter months. The price bid by the several companies was identical at each destination. As the price was as low as any previous year, the commission did not hesitate to accept the bids. In January the same cement companies engaged in a local price war in Illinois which resulted in a lower price in Illinois than Wisconsin.

"The Wisconsin highway commission has purchased cement each year since 1921 from the cement companies now doing business in Wisconsin, with the exception of four years. There have been occasions when cement prices were reduced during a construction season, but in every case Wisconsin was treated exactly the same as neighboring states. This is the first time that an attempt has been made to discriminate against Wisconsin."

The commission said that on three occasions, March 4, March 23 and March 28, it sought to have the companies adjust their contracts to the Illinois price without results. Its decision to have contractors furnish their own cement was followed by offers of reductions from only three of the companies, it said.—*Milwaukee* (Wis.) *Sentinel.*

President's Support Asked for Road Bill

PRESIDENT Hoover's support for the bill (H. R. 9642) now pending in Congress and carrying a total in appropriations of $136,000,000 for emergency highway construction was sought April 29 by a committee that called on him at the White House from the American Road Builders' Association.

The committee declared that the measure, if enacted, would "act as a throttle of the industry for the resumption of the construction and maintenance of highways so vitally needed."

In a statement of their views laid before Mr. Hoover, the committee, which was headed by Thomas H. Cutter of Jefferson City, Mo., president of the association, told him they were convinced as a result of a survey of highway operations that enactment of the bill at this time was not only desirable but necessary to the very life of the road-building industry.

The statement follows in full text:

"This delegation from the American Road Builders' Association represents all interests of the highway field. Our association is holding its annual business meeting here in Washington this week to outline policies for the coming year. We are pleased to tell you that for the first time in two years the tone of optimism prevailing at the meeting compares favorably with the optimism of prosperous times.

"Our association holds its annual convention in January, where our widespread contacts congregate from all parts of the United States and foreign countries, some 25,000 people representing leaders in the highway industry, including engineers and officials from states, counties and cities, as well as highway contractors, manufacturers and producers.

"At this time we are vitally concerned with the size of the highway program not only as it affects our industry directly but also as it affects the social, economic and commercial life of the entire population of the country.

"As a result of a careful survey of highway operations we are convinced that the emergency highway appropriation at this time is not only desirable but necessary to the very life of this most important industry, and in this connection we bespeak your favorable consideration of the highway emergency legislation which is now pending before Congress and which if passed will act as a throttle of the industry for the resumption of the construction and maintenance of highways so vitally needed."

California Rock Crushing Plant Nears Completion

CAPABLE of producing 1500 tons of crushed stone, gravel and sand per 8-hr. day, the new plant of Ed Johnson and Sons in the Tujunga wash near Roscoe, Calif., is almost ready to begin operation.

The finished, graded material is delivered to bins under which motor trucks load on a level with the road. Construction work has been under the supervision of R. B. Vaughn.

The Johnson crusher is to be operated under the wet process to eliminate the dust from crushing. The crusher is of the gyratory type.

The Johnsons are building and paving contractors and will use the product in their contracts, as well as selling it to others. There seems to be a general sentiment that prices of building materials will be reduced, the *Roscoe Register* states.

Building Lime Plant in Alabama

A NEW LIME PLANT is being built in Shelby county, Ala., by the Alabaster Stone Co., which is headed by George Scott. The plant is at Scotrock, on the main line of the L. and N. railroad between Birmingham and Montgomery. For several years the company has operated a quarry and Mr. Scott has now decided to re-enter the lime business, with which he had been identified for years.

The new plant will have two kilns and a hydrating unit. The hydrator has been erected and work is now in progress on the foundation for the two kilns. The steel frame for a building is also in place.

New Ready Mixed Concrete Plant in Atlanta

NUMEROUS central concrete mixing plants are being established in the South, and the use of ready-mixed concrete is growing, its use extending not only to foundation work and building construction generally, but also to roads, pavements and bridges, states a recent issue of the *Manufacturers Record.*

A new development of this type is the plant of Cromer and Thornton, Inc., Atlanta, Ga., which has a capacity of 300 cu. yd. of mixed concrete every 8 hr. In this plant the 28-S Rex mixer, driven by an electric motor, is placed under bins which hold 40 carloads of sand, gravel and crushed stone. The mixer is equipped with a Blaw-Knox 5000-lb. capacity weighing batcher for batching the aggregates direct from storage bins, the materials being handled from a tunnel beneath the railroad trestle by a Barber-Greene belt conveyor serving these bins. The company is using Mack trucks with square steel flat-bottom dump bodies for delivery equipment.

F. C. Sturmer is in charge of the engineering department of this plant.

Must Present United Front to Save Road-Building Industry

Popular Opposition to Diversion of Highway Funds Outspoken and Determined—Looting of Gas Tax Proceeds Continues

DURING 1931 motorists of the state of New York paid $71,000,000 in vehicle and gasoline taxes and got approximately 1000 miles of state highways. Unless a special session of the legislature can be called and will provide relief, motorists of that state will pay an estimated $92,000,000 in 1932 and will get only 355 miles of state highways.

This dire predicament was not consummated without a contest. In the recent session of the legislature it was fought at every turn. But before the public generally was aware of the situation, the bill which turned thousands of workers out of useful and highly productive work was passed through legislature and was signed by the governor.

The New York State Chapter of the Associated General Contractors in cooperation with other agencies prepared and presented to individual members of the legislature and to Governor Roosevelt an exhaustive analysis amply justifying continuance of highway construction on the 1931 basis. The New York State Automobile Association, the American Legion and other organizations swung into the fight. But politicians would not be moved, and when the smoke had cleared something like $47,750,000 had been "diverted," and the motorists were saddled with a 50% increase in their gasoline tax!

While the New York legislation was politely referred to as "emergency," no one can doubt for an instant that it will never be automatically or voluntarily undone—only a struggle backed by united sentiment throughout the state can ever break the iron grip which has closed around a fund created and intended only to build roads and employ highway labor.

Raises Taxes—Creates Unemployment

In the first instance, the legislature raised the gas tax; in the second instance, it diverted the extra gas tax money away from highways; in the third instance, it slashed the highway program to bits, and in the fourth instance, because some realized that people thrown out of jobs would have to be supported, more relief funds are to be raised.

In place of work, which would furnish employment to many thousands of men directly, and to still more thousands indirectly, the legislature reduced work, voted $5,000,000 for relief in the shape of unproductive charity, and put up to the people the issuance of $30,000,000 in bonds, also for charity.

Gasoline Tax Diversion

SOME SHORT-SIGHTED legislators and politicians, casting about for ways and means of making ends meet in government, find a happy idea in the proposition of appropriating a portion of the gasoline tax for purposes other than road building. That idea is a dangerous fallacy.

Gasoline taxes were devised for the construction of highways, and they are peculiarly suited to that purpose. The theory of the gasoline levy is that motorists help pay for the roads in proportion to the use they make of them.

Already one-fourth of the Texas 4-cent gasoline tax goes to the public school fund, for no other reason than that the Constitution requires that one-fourth of all occupation taxes be allocated to the school fund. Should any additional portion of the tax be diverted to general state revenue, as some office seekers propose, either the tax must be substantially increased or highway development must be considerably reduced.

No forward-looking citizen of Texas wants highway development retarded; if anything, it should be accelerated to facilitate state growth.—"Houston (Tex.) Post."

Railroads Affected

A statement recently issued by the New York State Construction Council throws significant light upon the action of the legislature from the viewpoint of its effect upon the tonnage carried by the railroads. This statement, as reported in the *Utica Press* of April 1, is as follows:

In 1931, railroads handled 155,000 carloads, or nearly 7,370,000 tons, of four materials used in public works construction. These items were cement, 1,075,000 tons; sand, 2,220,000 tons; stone and gravel, 4,046,500 tons; steel, 27,500 tons. (The steel item is for highway construction only.) This year, with a virtual two-thirds reduction in the volume of highway and other public construction, car loadings will be reduced accordingly. As against 155,000 carloads in 1931 there will be less than 55,000 in 1932. So, it is obvious that the railroads, most of which are now in a weak position, are going to be hit hard along with many other forms of business and industry, as a result of the legislative curtailment of public construction.

While these figures are of themselves very impressive, they are far from complete. The item of 1,075,000 tons of cement may fairly have added to it the movement of about 280,000 to 300,000 tons of coal required for the manufacture of the cement. Equipment, repairs, lubricants and supplies, returned sacks, and other items in connection with cement plant operation account for a large additional tonnage. The local movement of rock and clay from quarry to mill is a large additional factor. Similar movement into and about sand, gravel, steel and other plants provides the railroads with hundreds or perhaps thousands of additional carloads.

The New York State Department of Public Works has announced that the highway program financed for the fiscal year would be 356.55 miles, against 1019 miles last year. This is the plainest index to what has happened.

Instead of helping the state out of a depression, the reduction of the highway program means only that the legislature is throwing the state more deeply into the morass.

New Jersey Situation

Powerful forces also are at work in New Jersey to reduce state highway expenditures and to divert large sums of money collected from the motorists specifically for the improvement of the highways of the state.

Governor Moore's recent inaugural address dealt considerably with the administration of the state highway department and with public works. From quotations which appeared in the newspapers it seems clear that the governor had in mind the curtailing of road and other public construction as the easiest means by which funds could be obtained for present emergent requirements. Published reports quote Governor Moore as having said: "Road work in this machine age employs comparatively few men. No substantial increase in unemployment will be caused by delaying all highway work not vitally necessary."

There is no reason to doubt the governor's sincerity in making this statement, although it hardly could have been made with the advantage of available statistics covering the points involved. Nevertheless, it explains the governor's action in advising certain diversions of the money now employed in

state highway improvement. In order that Governor Moore might have the pertinent facts, the highway construction industry of the state, as represented by the New Jersey Constructors Association, decided to compile and present a complete statistical digest dealing with the subject at hand.

This analysis shows that the contractors regularly engaged in the construction of highways and bridges in the state employ 15,000 men. A check-up made during the construction season of 1931 showed that 12,000 men were actually employed on state highway and state-aid projects and that at least 3000 additional men were employed on projects other than the above.

A study of the chief industries producing commodities used in highway construction (sand, stone, gravel, cement, steel, and asphaltic products) and the railroads and other transport facilities employed in road building indicated that they furnished occupation for a far greater amount of labor, and substantiated the estimate by the U. S. Bureau of Public Roads that approximately two men are employed in the production and transportation of the materials of construction to each man employed by the contractors on actual road-building operations.

It was brought out in the statement that 85% of the materials used in the construction of highways and bridges originate in the state, giving employment to about 25,000 men, which with the 15,000 employed by the highway and bridge contractors, makes a total of 40,000 men whose livelihood depends upon state highway and bridge construction in New Jersey.

Contractors' Investment Large

Data submitted by the contractors show an actual capital investment of $15,000,000 by those engaged directly in carrying out the state construction program, of which sum fully $10,000,000 was spent for modern road-building equipment provided to take care of state work and of little value for any other purpose.

It was found that concerns producing sand, stone and gravel within the state had an investment of $15,000,000 and that the two cement plants located in New Jersey represented an investment of $10,000,000 and shipped 70% of their output for the construction of roads and bridges within the state. It was pointed out that the banks of the state were intensely interested in this large capitalization.

An interesting breakdown of contractor costs shows that out of every dollar paid for highways the contractor pays out 34 cents directly in wages and that 42 cents is paid out indirectly for labor by manufacturers of materials of construction and railroads and others providing necessary transportation. Thus accounting for 76 cents on the dollar as direct payment to labor, it was pointed out that a further breakdown would undoubtedly show that a considerable portion of the remaining 24 cents out of the dollar fell into the hands of workers as wages or salary.

According to the data submitted to the governor by the Constructors' Association, the New Jersey State Highway Department contracted for upwards of $40,000,000 worth of highways and bridges during 1931, either directly or through other governmental agencies which the highway department assists. In addition the statement estimates on reliable authority that the total of such work done during 1931 by the counties, townships and municipalities independent of the highway department amounted to about $15,000,000, making a total of about $55,000,000 worth of highway and bridge work contracted for by public authorities within the state during 1931.

These figures indicate that highway building furnished a payroll of about $40,000,000 last year, at the average rate of $1000 per worker for the construction season.

In the past the counties, townships and municipalities have closely followed the lead of the New Jersey State Highway in their policy in the construction of highways and bridges. The sudden cessation of construction by the New Jersey State Highway Department would tend to result in the stopping of this class of work by those subdivisions. The total dislocation of this great industry within the state would take place. Over 40,000 men would be thrown out of employment. Over $40,000,000 paid by this industry to the wage earners would be lost to them, and the state of New Jersey would have the direct added burden of providing for this tremendous additional number of unemployed.

The report to the governor continues:

"The present low prices of commodities used in the construction of highways and bridges, together with the extremely low prices at which contractors seem to be willing to undertake these projects for the state, makes the present time most propitious for the construction of highways and bridges.

"We believe that a dollar spent in 1932 will buy more construction volume than it has ever bought before, and more than it is likely ever to buy again. As a matter of good business, if for no other reason, the state of New Jersey ought to continue its highway and bridge construction program in 1932 in the same volume as it was carried out in 1931."

Noteworthy progress has been made in recent weeks by the gas tax diversionists in many states. In Rock Products for April 9 attention was called to a number of recent evidences of action by those who would take highway income for other uses, but that list was by no means complete.

Mississippi Situation

The motorists of Mississippi, who now pay a 5½-cent gasoline tax, are facing an imposing array of legislation designed to dig deeper into their pockets and at the same time divert the proceeds to purposes which may be fairly financed only by taxation spread over the entire group of taxpayers of the state. Here they are:

House Bill No. 258, increases gasoline tax to 6 cents, of which 3 cents would go to the state general fund.

House Bill No. 288, increases gasoline tax to 7 cents, of which 3 cents would go to the state general fund.

House Bill No. 310, increases gasoline tax to 6 cents, of which 3 cents would be turned over to the counties and 3 cents would go to the state general fund.

House Bill No. 334, increases gasoline tax to 7 cents, of which 1 cent would go to the state general fund.

House Bill No. 340, increases gasoline tax to 7 cents, of which 2 cents would go to public schools during 1932 and 1933.

Senate Bill No. 150, increases gasoline tax to 6 cents, of which 3 cents would go to the state general fund.

Senate Bill No. 234, increases gasoline tax to 6 cents, 50% to be turned over to the counties and 50% to the state highway fund.

Senate Bill No. 270, increases gasoline tax to 6 cents, of which 2 cents would go to the state general fund.

The significant fact about this proposed legislation is that all of these bills seek to impose heavier loads upon the motorist and all of them would divert anywhere from one-seventh to the entire proceeds from the purpose for which the gas tax was originally levied in Mississippi—to give the people of that state a reasonable system of improved highways, which it does not yet have.

At the close of 1931, Mississippi had 442 miles of concrete paved highway out of a state system comprising 6091 miles, with popular opinion voiced on every hand for the continuance of the construction program. Unemployment has reached a high point in the state, particularly among the laboring classes from which road workers are hired. From the standpoint of thousands of penniless unemployed workers the interference with the state highway program by the diversion of gas tax funds is a tragedy of first magnitude.

Activity Other Places, Too

The Rhode Island senate has before it Senate Bill No. 137, proposing to divert one-half the proceeds of the present 2-cent gasoline tax for the relief of unemployed persons. South Carolina House Bill No. 913 proposes to add 1 cent to the present 6-cent tax to pay off the deficit in state operating expenses. The Texas movement to increase the gasoline tax from 4 cents to 6 cents and to reduce the portion spent for highways from 3 cents to 1½ cents, was appreciably strengthened by resolution of the Farmers Union of Texas, recently meeting in Dallas.

Not content to let the suffering motorists of Florida (who now pay a 7-cent gasoline tax, most of which is diverted from road uses), the city council of St. Augustine passed an ordinance levying a 1-cent tax for local purposes, effective March 15.

These and other instances too numerous to be described in any one issue of this publication point plainly to the widespread and determined effort of politicians to dip deeply

into the public road funds in order that political machinery, with its extravagances, duplication, unnecessary functions and payrollers, may be continued.

Public Interest Growing

Public interest in the fate of highway funds is accumulating rapidly. Opposition to gas tax grabs is daily growing in volume and strength. Will it acquire sufficient momentum to hold in check the determined thrusts of the gasoline tax raiders?

The following are typical of the expressions coming to the attention of Rock Products during the last few days:

* * * * *

"Certainly the money spent in road building is spread out thin in the various classes it benefits, and so is intimately linked with the foundation upon which we must build back to normalcy.

"It is well, therefore, for our federal, state and local governments to consider well before sidetracking road funds to any other use."—*Atlanta Constitution.*

* * * * *

"The plan of diverting motor vehicle revenues does nothing but take bread from one man and give it to another. It substitutes the dole for useful employment.

"Many thousands of heads of families have been kept off the charity rolls by highway employment during the past year, and will be kept off these rolls during the coming months if highly funds are protected from diversion."—*Columbus* (Ohio) *Citizen.*

* * * * *

"Renewal of highway work in the spring is a sign that brings cheer to the thousands of men and families who depend on road building and its allied industries as a means of livelihood. More roadwork makes more jobs—and jobs create buying power all down the line."—*Seattle Daily Times.*

* * * * *

"The gasoline tax is being paid by millions of automobile owners without protest, as they have always had assurance that this tax would be kept inviolate for the purpose for which it was originally levied—the building and maintenance of good roads and the elimination of deadly grade crossings now responsible for the yearly loss of hundreds of lives in Ohio.

"To divert these funds to any other use than those for which this tax was levied would be a betrayal of pledged public faith. If a part of this tax is once diverted for other uses in so-called emergencies, the entire tax will presently be confiscated for purposes other than those originally intended."—*Columbus* (Ohio) *Dispatch.*

* * * * *

"The enormous payroll of the road industry is most noticeable when it is lacking. When construction stops either for seasonal halting of work or because road money collected in gasoline taxes is diverted into unrelated channels, the effect in added unemployment is apparent."—*Kansas City* (Mo.) *Star.*

* * * * *

"While automobile registration—that is, the number of cars in use—increased between 1921 and 1930 by 53.5%, taxes on automobile owners increased 435.1%. Meantime the amount expended on road construction increased only 58.9%."—Frederic J. Haskin in *Burlington* (Ia.) *Free Press.*

* * * * *

"Road construction has proven itself to be the best known method of public improvement for the relief of the unemployed. The various states have their organizations already at work and it simply means an additional number of laborers. Perhaps more unskilled labor is used on road construction than on any other given type of improvement. Last year over 3,000,000 men were employed directly or indirectly in roads and street building in the United States. More than 93 cents out of every dollar spent in road construction goes into the hands of labor."—T. H. Cutler, chief engineer, Missouri State Highway Commission, *Kansas City* (Mo.) *Times.*

* * * * *

"I ask you to resist any attempt to divert any of the gasoline tax. Devote these revenues entirely to the building and upkeep of the roads and we will in time have a highway system that will do credit to the state." —Former Judge W. O. Huggins, editor *Houston Chronicle* and president of the Gulf Coast Good Roads Association, in *Houston Post.*

* * * * *

"Automobile registrations demonstrated that the unorganized fight of the motorists against a tax they considered confiscatory must be widespread. January, 1931, before the $2 special tax was levied on each car for the benefit of the general fund, and before the gasoline tax was increased from 5 to 7 cents, 174,761 automobiles were registered in Tennessee, with a fee collection of $2,491,562. In January, 1932, after the $2 contribution to pay back the Caldwell loot of the state treasury was levied, the registrations were 133,562, with total fees of $1,894,330.48. Thus the treasury is $497,231 worse off for the month instead of registering an increase of more than $300,000 through the $2 extra tax.

"Part of the shrinkage of more than 40,000 in registrations is due of course to prevailing business conditions, but motorists are saying that the drop would not have been more than 10,000 or so if the extra burdens had not been imposed."—Chattanooga letter in *New York Times.*

* * * * *

"Aside from the lack of ethics in gasoline tax diversion, there is a very important reason why this money should be left in highway funds. Money spent for road building goes largely into the pockets of workmen."—*Washington* (D. C.) *Star.*

"It is conceded that the automobile industry will be a leader in the return of normal business. Clearly, in the face of the road improvements needed, a pickup in the automobile industry will be greatly retarded through the curtailment of road construction made necessary by diversions of gasoline tax money."—*Hoboken* (N. J.) *Observer.*

* * * * *

"The gasoline tax was created as a means of obtaining the large funds needed to build connected highways and surfaces that eliminate mud and give low cost motoring. Whenever gasoline tax money is diverted to other purposes than for road construction, it becomes a luxury tax. The abuse of the gasoline tax will in the end mean widespread demand for reduction in the tax rate and even abolishment."—E. E. Duffy in *Rochester* (N. Y.) *Democrat-Chronicle.*

* * * * *

"As far as the *Virginian-Pilot* knows, there has been nowhere in the United States a final judicial verdict on the right of a state to apply gasoline tax revenues to any other public purpose than that of building or maintaining the highways. There has been no court decision on this question in Virginia, although if the present agitation for an increased state gasoline tax for other than highway purposes continues and is translated into law, such a decision is likely to be forced early after the bill's enactment."—*Virginian-Pilot,* Norfolk, Va.

* * * * *

"Efforts of the Tennessee legislature to pass on to automobile owners the burden of wiping out the enormous deficit have developed into a boomerang which has floated back around the necks of the officials and bids fair to increase instead of eliminate the pressure. Resentful of the application of automobile taxes to other than road purposes, hundreds of motorists have placed their cars in their garages for the remainder of the year."—*New York Times.*

* * * * *

"Opposition to diverting highway revenues from the ends for which they are paid continues to grow. In the East, in the Middle West and on the Pacific Coast, as well as in the South, far-sighted officials, backed by strong public opinion, are insisting that funds intended for the construction and maintenance of good roads shall not be turned into other channels."—*Atlanta* (Ga.) *Journal.*

Reduce Gravel Rates in North Dakota

FREIGHT RATES on sand and gravel will be reduced one-third from Downer and Muskoda pits to Fargo and Moorhead, N. D., and also substantially reduced from Detroit Lakes, Minn., it is reported by agents of the Great Northern and Northern Pacific railroads.—*Fargo* (N. D.) *Forum.*

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

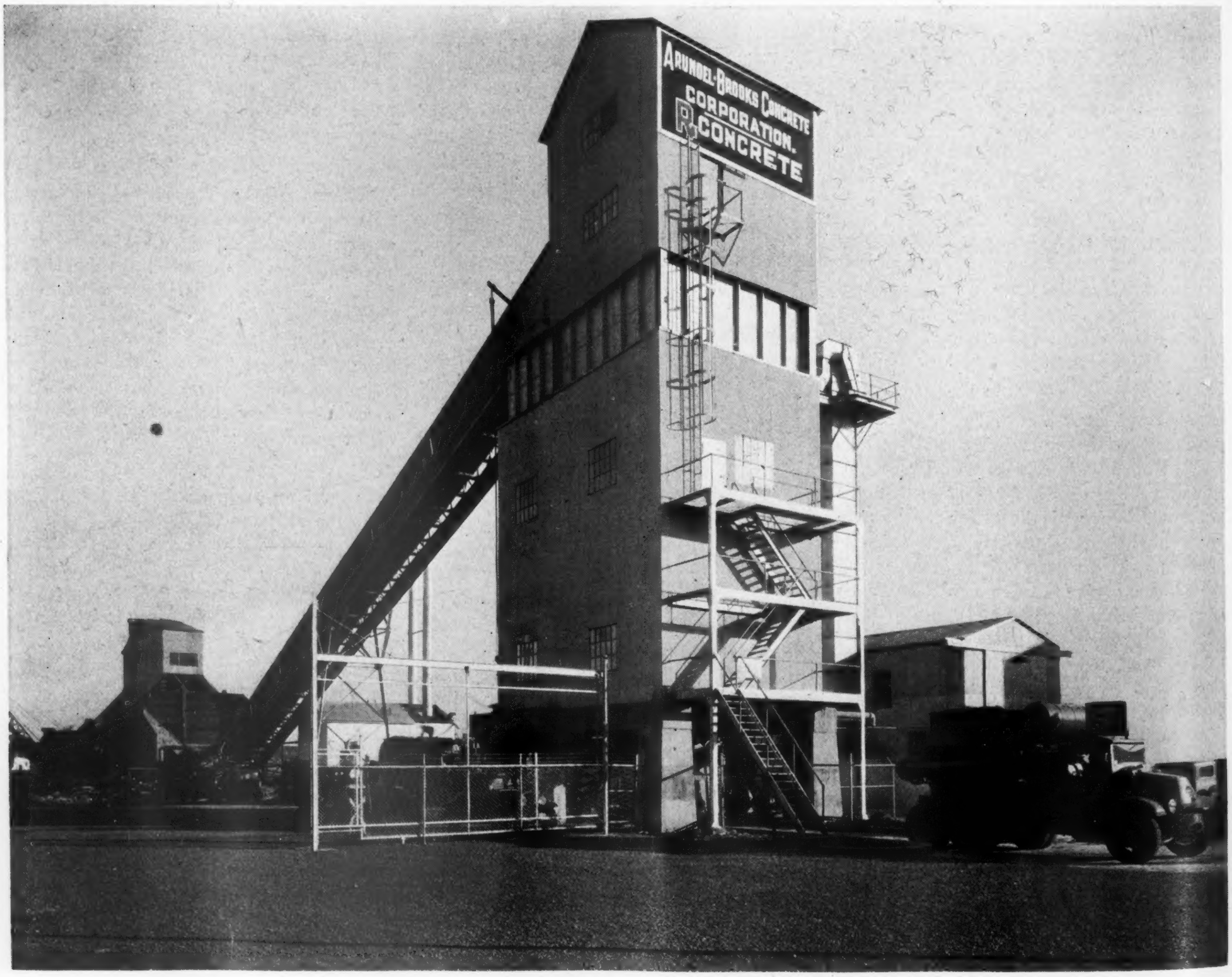
Baltimore's New 1000-Cu. Yd. Ready Mixed Concrete Plant

Arundel-Brooks Concrete Corp., Affiliated with Baltimore's Principal Sand and Gravel Producer, Builds Ultramodern Plant

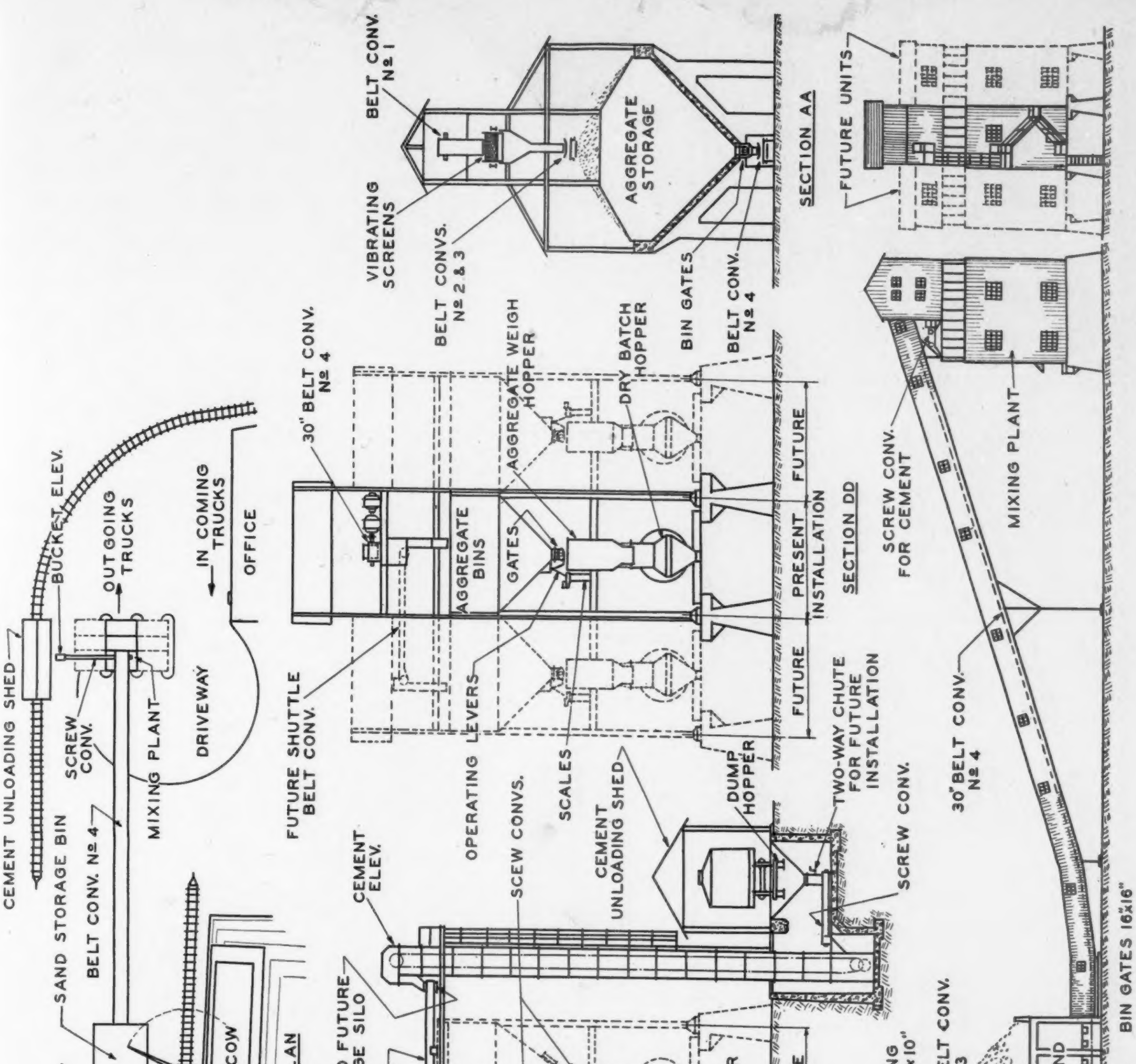
THE Arundel-Brooks Concrete Corp., Baltimore, Md., recently completed a new 1000-yd. daily capacity central-mixed concrete plant, unusual because of its simple and practical unit-arrangement and because of the novel method of marketing the concrete.

To emphasize the accuracy of its methods the company features the trademark "℞ Concrete," using the old druggist's prescription symbol, ℞, to show that the concrete is proportioned to the engineer's specifications as exactly as the doctor's prescription is tormulated.

The Arundel-Brooks company is a subsidiary company of the Sanford and Brooks



Plant of the Arundel-Brooks Concrete Corp., Baltimore, Md.



Details of the new plant of the Arundel-Brooks Concrete Corp., Baltimore, Md.

Cement-handling at Arundel-Brooks ready mix concrete plant

Co. and of the Arundel Corp., which is one of the largest and most successful sand and gravel producers in this country.

The officials of the Arundel-Brooks Co.—F. A. Furst, chairman; W. B. Brooks, Jr., president; J. J. Hock and S. B. Brooks, vice-presidents, and R. A. Froehlinger, secretary—are engineers who through experience in contracting and construction projects recognized the economic advantages and possibilities of central-mixed concrete. They had seen the rapid development of this new industry and planned the new plant for the addition of future units and the new methods that are bound to appear in the next few years.

The plant was designed and erected by Arundel-Brooks engineers under the supervision of George Bacot, plant engineer. The Stephens-Adamson Manufacturing Co., Aurora, Ill., was consultant on the job and furnished the material handling, storing and batching equipment and all structural steel work.

Merchandising Plan

With the completion of the mixing plant last December, a unique marketing plan was devised to insure the confidence and good will of the contractor and user of ready-mixed concrete. This plan has enabled the Arundel-Brooks company to produce guaranteed concrete of any strength, with the most economical mixtures.

The success of the plan lies in the selection of an engineer of unquestioned ability and reputation to test raw materials and to proportion and certify the concrete sold under the ℞ trademark. The well known engineering firm, E. L. Conwell and Co., Philadelphia, Penn., was retained and a laboratory was established at the plant. Inspectors test and check each carload of cement and every lot of gravel before they are accepted. Correct allowances are made for the characteristics of the different materials, moisture content, etc., thus users can be sure that ℞ concrete will be up to required strength.

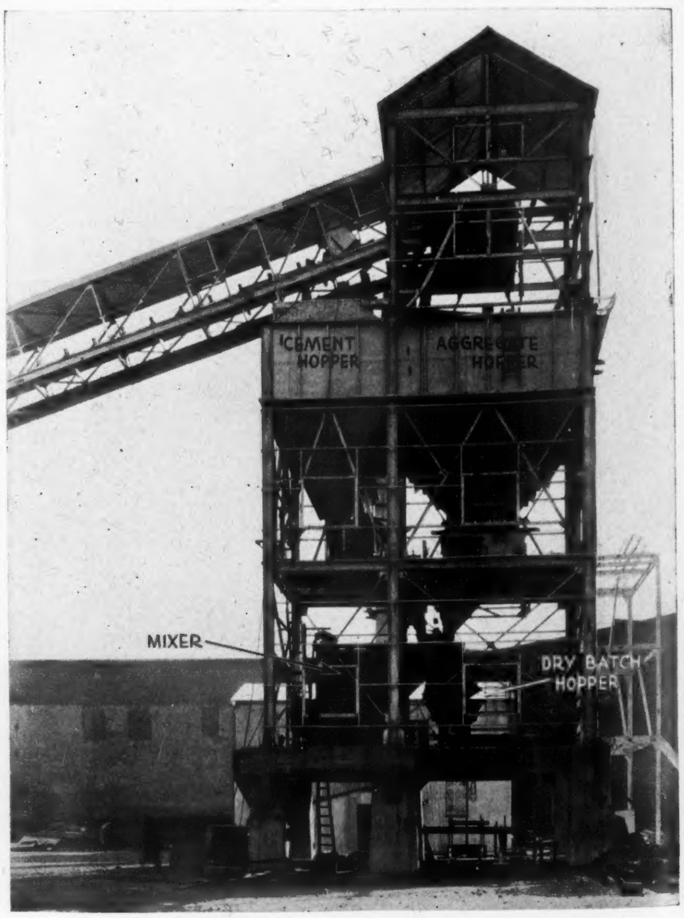
Arundel - Brooks sales engineers are trained in the concrete requirements for different types of structures and sell by personal interviews with users. The price per cubic yard is based on the strength and proportions required.

The plant, laboratory and office are located on the Baltimore water front, where materials are received by both barge and rail.

Screening and Washing

The Arundel-Brooks installation consists of a screening, washing and storage plant for sand and gravel; cement unloading and conveying machinery and a mixing plant. The mixing plant is built on a "unit" plan. The present unit has a daily capacity of approximately 1000 cu. yd. of concrete. One or two similar units can be added at any time and served by the present screening plant and cement handling conveyors.

Sand and gravel are received in scows from dredging operations in Chesapeake Bay. Two or three scows can be run into the slip at once and unloaded by a locomotive crane with a 1¾-yd. bucket. Sand is unloaded direct into an open section of the 120 ft. long, 3000 cu. yd. capacity concrete storage bin. Gravel is unloaded into an elevated dump hopper which feeds a revolving washing screen. This screen is of Arundel-Brooks' own make and is used to scrub and wash out silt and fine material. The washed gravel is then conveyed by No. 1 belt conveyor (24 in. wide by 156 ft. centers) at a rate of approximately 300 tons per hour to



View of the plant before enclosure

the screening plant over the storage bins.

Two 5 ft. by 10 ft. Stephens-Adamson single-deck vibrator screens separate the gravel into four sizes, pea, ¾-in., 1¼-in. and 1½-in. to 2½-in. S-A belt conveyors Nos. 2 and 3 (24 in. by 17 and 12 ft.) convey the oversize from each screen to the further sections of the storage bin. The gravel is given a final washing and rinsing as it passes over the screens.

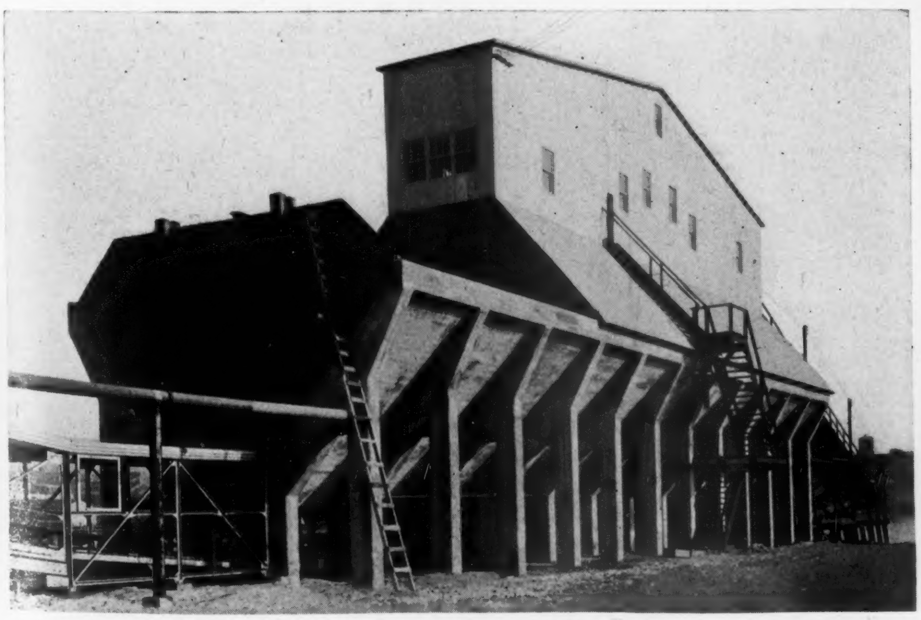
Sand and gravel received in barges, bins to right

At present the concrete storage bin is a self-cleaning unit, 120 ft. long, but it can be increased in length if necessary. Material can be drawn from any of the five sections of the bin through 16-in. by 16-in. S-A duplex swinging quadrant gates. Belt conveyor No. 4 (30 in. by 372 ft. centers) collects from beneath the storage bin and carries up to the live storage bin over the mixing plant. The conveyor belt is driven at a speed of 435 ft. per min. and has a capacity of 500 tons per hour, enough for any future mixing plant units that may be added. The conveyor gallery is made in two sections with an expansion joint between the lower horizontal run and the 230 ft. inclined section.

At its head end, over the mixing plant bin, the conveyor discharges into a 5-way distributing chute. This has a "stone box" or shelf to allow material to form its own wearing cushion. Sufficient headroom has also been allowed for a future shuttle type belt conveyor which can be rolled to either side to carry material to similar distributing chutes over future mixing plant units.

Cement Handling and Storage

Cement is received in enclosed gondola cars, especially built for handling cement. These cars are spotted in an unloading house which can be entirely enclosed during the unloading process. The cars are dumped into a 15-ft. square track hopper from which the cement is drawn by a 14-in. diameter by 12-ft. long S-A screw conveyor. An S-A continuous bucket weather-tight elevator of 79-ft. centers elevates from the screw feeder to a second 14-in. diameter screw conveyor 43 ft. long. This conveyor delivers at a rate of 40 tons per hour to either of two cement storage compartments over the mixing plant. The cement unloading and storage system will also handle a second mixing plant unit without change. If a third unit is added it will only be necessary to lengthen the upper conveyor about 20 ft.



Storage bins for sand and gravel, screening and washing plant

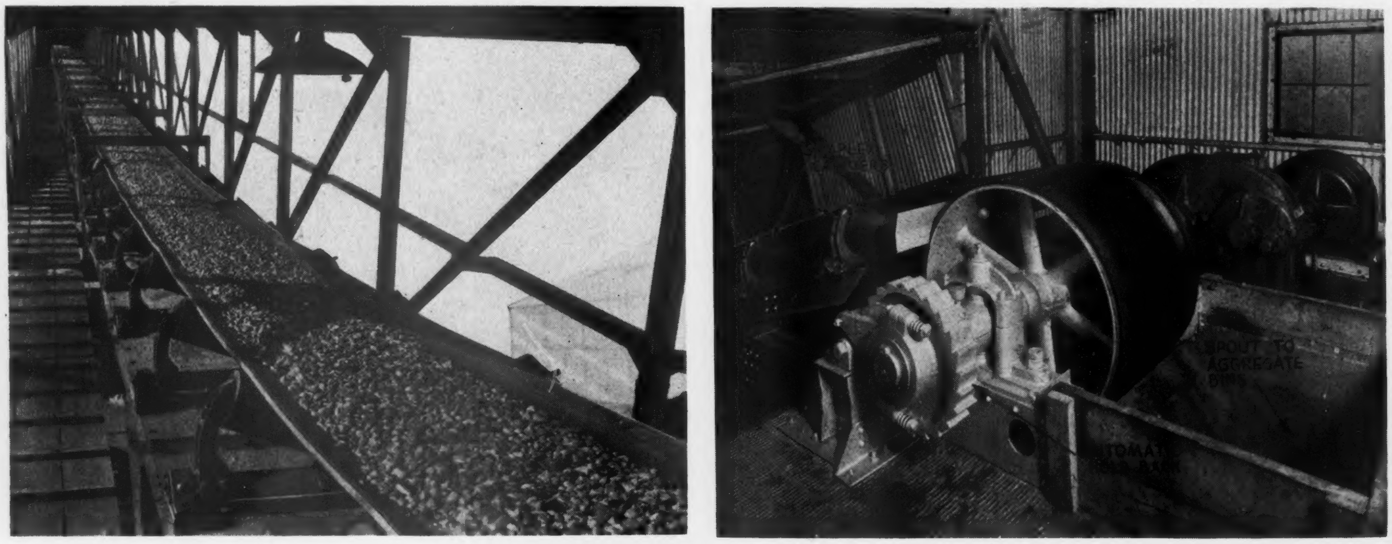
Mixing Plant

The present mixing plant unit consists of overhead storage bins for raw materials; feeding and weighing equipment for proportioning; a cement mixer and a hopper for collecting dry batches. The aggregate bin is separated into five compartments. The cement bin has two compartments, separated by a double vertical wall. Each compartment is hoppered on three sides and vertical on the fourth. The hoppered sides are equipped with air jets to prevent bridging, while the vertical side is provided with three covered vents near the bottom. There are no inside stiffeners and no shallow valley angles to retard discharge. On the other hand, the bottom of each compartment has a rapid-acting emergency gate operated by a Hanna Engineering air hoist to prevent over-aerated cement from flowing faster than desired. As a matter of fact, none of these precautionary measures have ever been used, but they are inexpensive insurance against uneven discharge.

Part of the screening plant

All storage bins discharge into the control room where the concrete batches are proportioned. Cement is automatically fed from either compartment by two special S-A screw feeders. These feeders have solid, multiple-thread screws for uniform dis-

Construction view showing conveyor installation

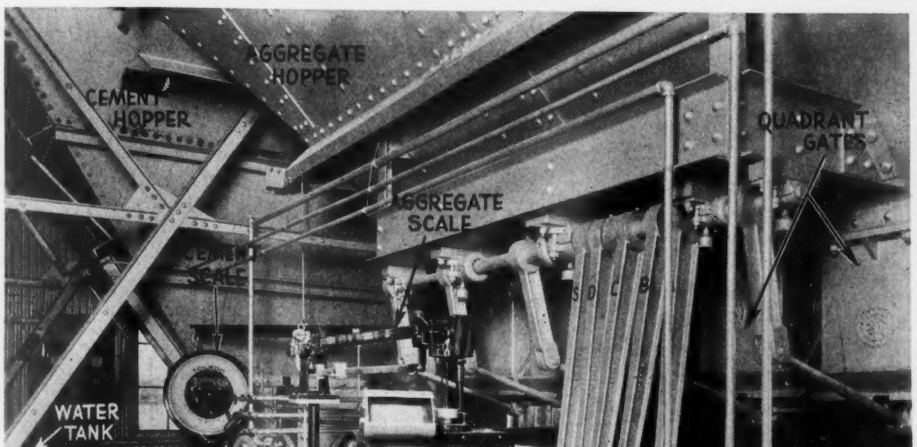


Details of the sand and gravel handling conveyor

charge and have close fitting cylindrical casings to prevent any leakage as feeder stops. The feeders are started manually but are stopped automatically by a 6000-lb. capacity Toledo dial scale equipped with G-E photocell control. The scale can be set for any weight and when the pointer swings to the desired point it intercepts the ray of light shining into the photocell. This automatically trips a relay and stops the feeder instantly. The cement weigh hopper has a 50-cu. ft. capacity and is dumped by means of a special hand operated self-seating valve with a Linatex rubber seal.

One-Man Operation

Sand and gravel are fed into the 261-cu. ft. capacity aggregate weigh hopper through S-A hand operated quick action quadrant gates. A 20,000-lb. Toledo beam scale equipped with a Howe weightograph with 5-lb. graduations enables the operator to proportion his aggregates accurately. This weigh hopper is also dumped by a hand operated self-seating valve.



One man controls all proportioning operations

Particular pains have been taken to keep the charges of dry cement and the damp aggregates apart until they actually reach the mixer or the batch hopper. In this way caking and the liability of errors in weight have been eliminated.

Both weigh hoppers dump over a flop gate into the dry batch hopper or directly into the special 4½-cu. yd., 126-S Ransome mixer, which is the largest non-tilting type mixer built to date. This is driven by a 75-hp. G. E. motor.

The routine of proportioning and mixing has been very carefully synchronized so the entire operation can be handled by one man located in the control room.

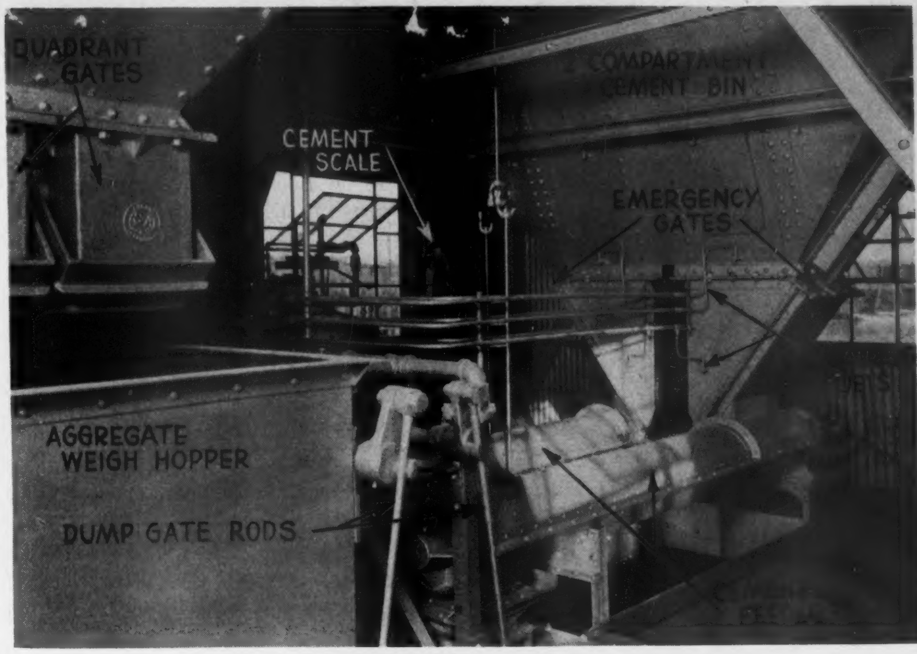
Handling an Order

When an order is received it goes to the "make-up" man in the laboratory. He figures proportions and makes out a schedule of weights on the job ticket—very much as a prescription is written. He takes the

ticket to the control room where the cement weight is set on the dial scale.

As soon as the cement scale dial is set, the feeder from either cement compartment can be started (it will stop automatically). The operator then steps to the beam scale for aggregates. He opens the gate for the first kind of aggregate and draws the required amount. This can be done very accurately by closing the gate as the weightograph pointer approaches the desired weight. Then by a few quick strokes of the lever the exact amount is reached. He then draws the other kinds of aggregates, as specified on the job ticket.

By the time the sand and various sizes of gravel have been collected, the cement charge will have been drawn and the feeder stopped. The inspector checks weights and certifies the batch while the operator turns the hand wheels which dump the two weigh hoppers into the mixer or to the batch hopper. Water is measured volumetrically by a Ransome water batcher and the gage is set for the proper amount. The measured volume of water is then drawn into the Ransome mixer or into the mixer trucks.



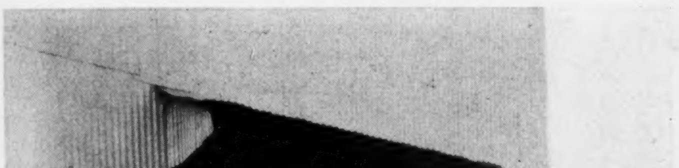
Material proportioning and control room of plant

Deliveries

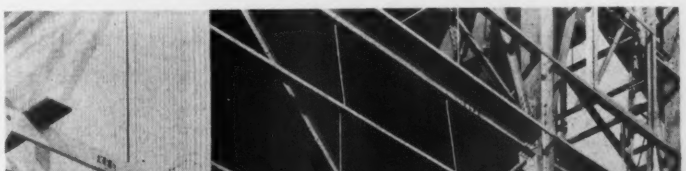
Fleets of 3- and 4½-cu. yd. mixing and agitating trucks are used for delivering. They are spotted beneath either the mixer discharge or under the dry batch hopper. Rex Moto-Mixer bodies are used on Mack and Autocar truck chassis. At the job the "Jackass" hoists raise the mixer bodies high enough to discharge into forms 8 ft. above the ground level.

All belt and screw conveyors were made by Stephens-Adamson Manufacturing Co. Goodyear 5- and 7-ply conveyor belting with ⅛-in. rubber covering on carrying surface is used and the Simplex conveyor carriers are equipped with Timken bearings. Each of the inclined conveyors has an S-A automatic safety pawl to prevent the loaded belts from running backward in case of power failure. The screw conveyors are all dust and weather-tight.

Enclosed speed reducers are used on all



Mixer discharging to agitator type truck



Construction view showing method of charging mixer

conveyor drives. Falk herringbone reducers are used on the long belt conveyors Nos. 1 and 4. DeLaval worm gear reducers are used on belt conveyors Nos. 2 and 3, on all cement screw conveyors and feeders and on the elevator drive. The majority of the drive motors are by General Electric Co., which also furnished the control equipment.

Conveyor galleries, building and machinery framework were fabricated by Stephens-Adamson and erected by Arundel-Brooks. Corrugated sheeting was used to cover galleries and to enclose buildings. The equipment also includes a hot water system for heating mixing water and two steam boilers for heating the raw materials in cold weather.

The Arundel-Brooks plan of inspection-of-materials and certification-of-batches seems to have taken hold very nicely and has overcome one of the main objections to central mixed concrete. Most contractors and architects freely admit the economy and possibilities of ready mixed concrete. In some cases, however, there has been a conscious or unconscious misgiving about using this material, as important as structural steel, but so dependent upon variations in materials and proportions.

Some concrete producers have met this objection by guaranteeing strengths. However, to avoid any possiblity of ruinous rejections and replacements, they have been inclined to allow an excess of cement. This practice may be safe, but it increases the cost of the concrete unnecessarily.

By this Arundel-Brooks method of retaining a responsible third party, the producer is assured uniform and economical mixtures, while the contractor can depend upon receiving concrete that has been as scientifically proportioned as if it had been produced by his own organization.

American Limestone Co. Buys Ready Mixed Concrete Co.

SALE of the physical assets of the Ready Mixed Concrete Co., Knoxville, Tenn., for $6820 to the American Limestone Co. was reported in chancery court recently by R. S. Campbell, receiver. He asked that the court approve the sale, which was done.—*Knoxville* (Tenn.) *Journal.*

Canadian Nonmetallic Minerals in February

DATA on the production of nonmetallic minerals in Canada in February, 1932, have been issued by the Dominion Bureau of Statistics and include the following:

PRODUCTION OF LEADING MINERALS IN CANADA

	February, 1932	Two months ending 1931—Feb.	Two months ending —1932
Asbestos, tons	7,706	26,388	17,896
Cement, bbl.	235,895	761,490	506,659
Feldspar, tons	945	977	1,745
Gypsum, tons	5,454	29,162	11,216
Lime, tons	23,632	50,737	47,317
Salt (commercial), tons	12,477	21,542	21,912

Will Hold June Safety Campaign as Usual

ANNOUNCEMENT has just been made that the June No-Accident Campaign, conducted by the Portland Cement Association in its member mills during the past seven years, will be held as usual during June, 1932.

Dry Ice Firms Merge

THE SOLID CARBONIC CO. and the Dry Ice Corp. of America, two of the pioneer manufacturers and distributors of solidified carbon-dioxide, popularly known as dry ice, have been amalgamated.

The combination, with manufacturing plants at Niagara Falls, N. Y., Deepwater Pond, N. J., Elizabeth, N. J., and Peoria, Ill., will control substantially more than half of the entire capacity of the industry with a wide distribution throughout the east and middle west.

The merger, among other advantages, will provide the means for expanding activities of these units in territories showing the greatest promise of increased sales. An adequate supply of raw material will be assured through arrangements with Union Carbide and Carbon Co., E. I. du Pont de Nemours and Co. and Commercial Solvents Corp.

Pioneer Cement Chemist

CHARLES SPACKMAN, who died at Clitheroe, Lancashire, England, on March 11, was born at Cheltenham in 1848. After being educated privately he studied science at Birmingham, where he became keenly interested in architecture, an interest that led him to accept the offer of an appointment to the architects' staff engaged upon the reconstruction of Alexandra Palace, in the early 70's. A few days after the completion of this work the palace was destroyed by fire, Spackman narrowly escaping with his life. Continuing his scientific studies, he devoted much attention to chemistry in general and to the chemistry of cement in particular. After holding the post of chemist to the Birmingham sewage works he designed and constructed the Burnley sewage works, and later he became chemist to the Folkestone Portland Cement Works, an appointment which enabled him to gain a wide experience to which his success as a cement chemist can be traced. Subsequently Spackman designed and constructed cement works in Leicestershire, the kilns which were installed being his own invention. After managing these works for some time he went to Clitheroe, where he built his own factory—the Isis Portland Cement Works. During the war he rendered valuable assistance to his country, particularly by devising a process for calcining magnesite for the lining of steel furnaces; and when, at a later period, the Department of Agriculture and Technical Instruction in Ireland decided to establish the cement industry in Ireland, it was but natural that Spackman's assistance should be sought; and in a consultative capacity he gave much help to the department. Spackman was not only an eminent technologist and a successful manufacturer, he was a capable writer who contributed largely to the literature on cement, one of his early papers being "Portland Cement," which he read before the Nottingham section of this society [British Society of Chemical Industry] on December 21, 1887—the year in which he joined the society. This paper was published in the *Journal* on February 29, 1888. He wrote that well-known book entitled "Some Writers on Lime and Cement," which covers the period from Cato (234-139 B.C.) to the date of publication.—*Chemistry and Industry.*

Urges Tariff on Phosphate

UNLESS PROTECTION is forthcoming for the Idaho and northwest phosphates mining industry, suspension of fertilizer production from this section is inevitable, Secretary L. F. Parsons told members of the Idaho congressional delegation in letters recently.

Phosphates mining in Idaho could be greatly increased if plants to manufacture the fertilizer were able to compete against the dumping of phosphates on the United States market by Japan, Belgium, Holland, England and Canada at prices lower than the cost to manufacture the product here, Mr. Parsons pointed out.

Four fertilizer plants in California, to which Idaho rock phosphates would be sent, are now closed due to this foreign dumping at unreasonably low prices, and the large deposits of phosphates in Idaho are neglected.

The most probable form of protection to be offered the industry lies in a restrictive tariff on phosphates, a measure which the Idaho delegation was requested to sponsor.—*Boise* (Idaho) *Statesman.*

Fertilizing Value of Green Sand

THE TEXAS greensand deposits vary in composition of P and K but some contain 3-6% each of P and K, a bulletin of the Texas Agricultural Experimental Station reports. The K of greensand is insoluble in H_2O but soluble in strong acids. Pot greenhouse cultures with corn and kafir showed the availability of the P varied from 0 to 40% that of superphosphate, while the availability of the K of greensand was about 12% that of soluble K salts. An average availability for the P and K in greensand was, respectively, 10 and 8%. The substance does not contain enough fertilizing material to justify attempts to sell it as a commercial fertilizer.—*Chemical Abstracts.*

Asks More Consideration on Federal Construction

IN THE INTEREST of an industry that employs almost 7000 workers in New Jersey, G. V. Nightingale, of the Structural Gypsum Corp., recently visited New Jersey members of Congress to ask that they exert influence to the end that gypsum be used more generally in the specifications for federal buildings.

Mr. Nightingale complained that he has been unable to prevail on Ferry K. Heath, assistant secretary of the treasury in charge of construction, to make use of this company's products.

"In view of existing conditions and the fact that our New Jersey plants alone represent investments of $30,000,000 and furnish work for nearly 7000 men, we feel we are entitled to more consideration than we have been receiving," Mr. Nightingale said. —*Camden* (N. J.) *Courier.*

Pioneer Sand and Gravel Co. Acquires Building Material Firm

CONTINUING the policy of steady growth and expansion, the Pioneer Sand and Gravel Co., Seattle, Wash., has acquired the Seattle interests of McCracken-Ripley Co., building material dealers.

The Pioneer company will distribute all the lines previously handled by McCracken-Ripley, among which are high temperature cement, plastic fire brick, protective coating and industrial cleaning compounds.

B. F. Morris, president of the Pioneer Sand and Gravel Co., states that this latest expansion will give northwest architects and builders as complete a material service as can be found anywhere in the country. The Pioneer Sand and Gravel Co. recently established a steel division for the distribution of reinforcing steel bars and nails manufactured by the United States Steel Corp.—*Seattle* (Wash.) *Journal of Commerce.*

Committee on Mass Concrete Meets

A MEETING of the committee on mass concrete of the American Concrete Institute was held at the University of California, Berkeley, Calif., recently. Papers presented by Hubert Woods, H. H. Steinour and H. R. Starke gave results of investigations of relation of chemical composition of cements to heat generation and strength at the laboratory of the Riverside Portland Cement Co. There were also reports of interest on concrete installed at the Owyhee and Ariel dams in Oregon, the Pardee dam of the East Bay district and the Rodriquez dam in Mexico.

The work of the committee is being prosecuted to develop the best formula for cement for use in the Hoover dam.

To Develop California Granite Deposit

ONE of the large granite deposits in California will be opened up by the Del Monte Properties Co. when work starts on the new link of the 17-Mile Drive and the Spanish Bay project. This deposit is located on the Pacific Grove-Carmel road.

"We have known of this granite deposit for some time," said President S. F. B. Morse, "but owing to its location we never did much about it. Recently, however, our engineers have made thorough examination of the property, and we find it is bigger than we had believed.

"With the opening up of this property we should be in a position to supply granite for road work and building construction for this whole territory at a much lower rate than has hitherto been paid. The stone is of a very high grade. We shall use the outside strippings as foundation for the 17-Mile link and then we will be into the solid formation."

Work on the Spanish Bay project and the new 17-Mile Drive link will begin as soon as the road connecting Asilomar and the Pacific Grove-Carmel road is accomplished or assured. The company is proceeding with its plans, so that development will proceed without delay just as soon as that work has started.—*Pacific Grove* (Calif.) *Tribune.*

Builds Asphaltic Concrete Plant

THE M. J. Grove Lime Co. announced recently that it has closed a contract with the Marilite company, a subsidiary of the Union Paving Co. of Philadelphia and Washington for the erection of an asphaltic concrete manufacturing plant at Grove, near Frederick, Md.

The Marilite company is engaged in the manufacture and sale of bituminous paving materials. It investigated the quality of various limestones throughout the state and found that the deposits of limestone adjacent to Frederick were most adaptable to the manufacture of an asphaltic concrete, the *Frederick Post* reports.

The company will be located on Grove property about one mile east of this city. The Grove company produces crushed stone and lime.

Celebrates Silver Anniversary

THE ILLINOIS Powder Manufacturing Co., St. Louis, Mo., is celebrating its 25th year as a manufacturer of explosives.

The company was organized May 3, 1907, by J. L. White, president and founder. In announcing its silver anniversary it states that "believing safe practice in the manufacture, transportation, and use of explosives should ever be an important consideration with the user, we feel nothing could be more appropriate to the occasion than a resumé of the subject 'Safety in the Handling and Use of Explosives.' The announcement is therefore in booklet form and contains a 47-page discussion of this subject."

Exclusive Right to Use of Term "Dry-Ice" Sought

A PETITION seeking the determination that it and its licensees are entitled to the exclusive use of the trade mark "Dry-Ice" applied to sold carbon dioxide, which is employed as a refrigerant, has been filed with the supreme court of the United States by the DryIce Corp. of America.

An injunction is also sought restraining the use of the term for solid carbon dioxide in the corporate titles and advertising of competitors. The petition requests the court to review the decision of the circuit court of appeals for the fifth circuit, holding that the term was not subject to registration as a trade mark for the product and refusing to grant the injunction sought.

The lower court ruled, it is explained in the petition, that "Dry-Ice" is descriptive of characteristics or qualities of solid carbon dioxide and therefore was not subject to trade mark registration. The registration of the term was declared invalid. It also held that competitors cannot be prevented from using the term in their corporate titles and advertising if their actions in so doing are unaccompanied by any wrongful conduct having the effect of falsely representing the source or their product or attempting to palm it off on the purchasing public as the product of the DryIce Corp. or its licensees.

It was found as a fact by the lower courts, according to the petition, that the petitioners' use of the term "Dry Ice" had established a secondary meaning in the minds of the public as denoting its product. "The use of a term to which a secondary meaning has attached in the corporate title of a competing corporation is in and of itself so likely to cause confusion," it is claimed, "as to be subject to injunction."

Relative to the right to register the term as a trade mark, the petition states that "this case presents a situation where the lower courts have held descriptive two words in paradox which at the time when conceived were not descriptive of the goods, consequently could not be descriptive of the characteristics of the goods and were in no sense a measure of quality.

The term "Dry Ice" does not, it is contended, "state or describe the fact that solid carbon dioxide is or may be used as a refrigerant. 'Dry Ice' does, however, suggest the function of the article in question." The fact of suggestion is not a sufficient ground, it is pointed out, for invalidating the registration of the term as a trade mark.

The petition was filed in the cases of Dry Ice Corp. of America et al. v. Louisiana Dry Ice Corp. et al., No. 875, and Dry Ice Corp. of America et al. v. Belt, etc., No. 876.

New Machinery and Equipment

Lubricant and Wear Tester

AN INNOVATION in testing equipment is announced by the Timken Roller Bearing Co., Canton, Ohio. It is a small machine to test the load carrying capacity of lubricants and the wear of various materials.

The equipment is practical for plant tests, so that each shipment of oil may be checked, and the best oil for operations having different requirements may also be determined. In addition it offers a practical way to test friction of surfaces and to measure their wear, the manufacturer states.

Beside the general application of this device in rock products plants for checking lubricants it offers an interesting possibility for testing comparative abrasive qualities of various aggregates in concrete. Comparative results may be obtained by weighing the specimens before and after the test to determine the amount of material which has been removed. There are no doubt other applications for a testing device of this nature in the rock products field and it is one which makes such tests simple and practical for any operator.

Convertible Shovel and Crane

A NEW ⅜-yd. tractor shovel and crane recently announced by the Austin Machinery Co., the manufacturing organization of the Austin Road Machinery Co., Chicago, Ill., has a number of novel features, the chief of which, it is claimed, are more dumping height, greater dipper capacity, greater portability, and a large number of roller bearings. Among other features is the dipper handle, which is made up of two rectangular steel tubes to which are welded the crowd racks. The shipper shaft gears on which these racks run are one solid alloy steel casting with the two pinions and drive sprocket hub in one piece. This gear turns on two large roller bearings on the shipper shaft and is driven by a roller chain from the crowd mechanism on the turn-table. The driven sprocket is made of steel with cut teeth and secured to the hub by rivets so that it can be removed without difficulty. The shovel is equipped with an all-welded 11 cu. ft. bucket.

A feature of the boom, formed of two 12-in. channels, is the curved upper end to give greater clearance for the dipper handle. This provides a maximum dumping height of 17 ft. 10 in. with a boom angle of 55 deg.

The main frame of the shovel and the "A" frame forming the support for the upper end of the mast are of structural steel units, the A frame being welded to form a solid unit.

The crawls are 10 ft. 6 in. in length and measure 7 ft. 8 in. in total width. Each is controlled independently by the operator. Speeds as great as 4 mi. per hr. are possible, it is claimed.

Other mechanical features incorporated in the design include booster type clutches, readily renewable brakes, high pressure lubrication of all points and accessibility.

There are six roller bearings on the crowd shaft and 32 fully enclosed and sealed roller bearings in all. This large number of anti-friction bearings has made it practical to reduce the size of the power plant, the manufacturer states, and savings in operating costs are proportionately affected.

Interchangeable clutches are of a standard tractor design so that they are available in many places. Cut gearing enclosed and running in oil is another interesting feature on this small shovel.

A mounting of rubber-tired wheels for quick transportation and tow behind a truck is provided, and a speed of 25 mi. per hr. in transportation is thus practical. It can be mounted for transportation in 10 min. and demounted in 5 min., the manufacturer states.

Five major conversions are possible: A clamshell attachment with a 25-ft. boom and a bucket with ⅜-yd. digging capacity and ½-yd. rehandling capacity, a 48-in. back filler, a trench hoe, a dragline with 25 ft. boom and 10 ft. bucket, and a crane. The crane boom is built with a telescopic extension and as a crane will handle loads of 3000 lb. at a radius of 15 ft.

Light, portable equipment of this character is useful in many operations about rock products operations and much interest is being shown by operators in the smaller sizes of shovels.

Grants Rights to Manufacture Wire Rope

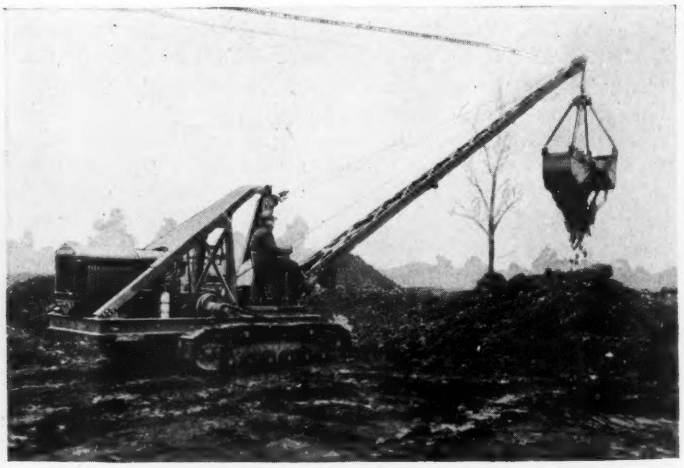
THE AMERICAN Cable Co., New York, N. Y., announces that the Macwhyte Co., Kenosha, Wis., has recently been added to the long list of wire rope manufacturers licensed to manufacture preformed wire rope under the American Cable Co.'s patents.

Other companies in the United States who are licensed to make preformed wire rope are: American Steel and Wire Co., Broderick and Bascom Company, E. H. Edwards Co., Hazard Wire Rope Co., Pacific Wire Rope Co., General Cable Corp. and the Wire Rope Manufacturing and Equipment Co.

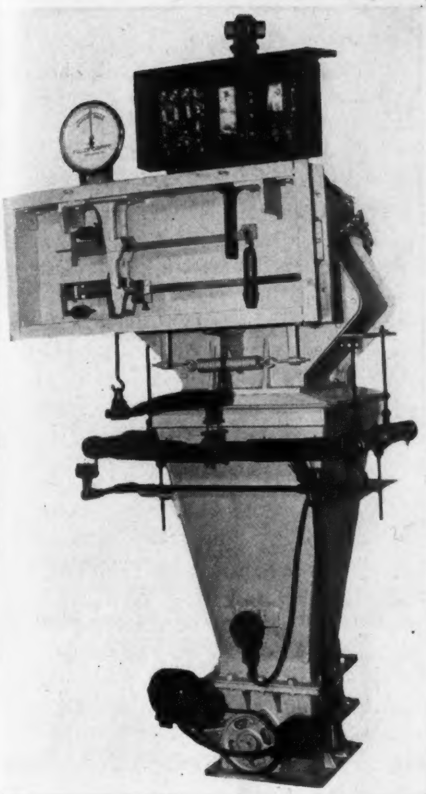
Bulk Cement Weighing Batcher

THE FULLER CO., Catasauqua, Penn., announces a weighing batcher for cement which is adapted for loading cars, barges and trucks at cement mills, as well as for batch-

Boom has curved upper end



Five major conversions are possible



Automatic for continuous loading

ing bulk cement in mixing plants. This batcher is made in different sizes to care for the specific requirements of an installation and is available in capacities up to 500 bbl. per hr. for cement mill service. The different sizes are essentially alike except as to size and speed. The batch counter of the larger machines may be set for any predetermined load and the machine will run continuously until the desired load has been discharged.

Features which the manufacturer claims for this batcher are accuracy, speed, no flooding or flushing, remote push-button control, and tamper-proof weighing with discharge gate locked against both over and under weights. An important element in the accuracy of this batcher is the Fuller rotary feeder which is flood-proof, the manufacturer states.

In construction and operation, when the tare weight is balanced, and the poise on the weigh beam set for the desired batch, the casing may be sealed and locked, as operation is completely under remote control. The starting push-button may be closed to start the closing of the discharge gate. This circuit is immediately broken and the interlock controls all further operation; to prevent any effect on the operation by improper manipulation of the push-button. The feeder starts when the discharge gate is closed and locked, and stops when the weigh beam comes to balance. The feeder motor circuit is compensated to allow for the cement in suspension as the roll stops. The discharge circuit is then completed so that the operator may discharge the batch by closing the push-button. The batcher cannot be discharged if the batch is not within the desired tolerance of over or under weight. The discharge may be controlled to prevent loss by splashing out of truck containers, and when the gate is completely opened, holding the push-button in the closed position operates the vibrator. The discharge gate cannot be closed nor the feeder started until the hopper is completely empty.

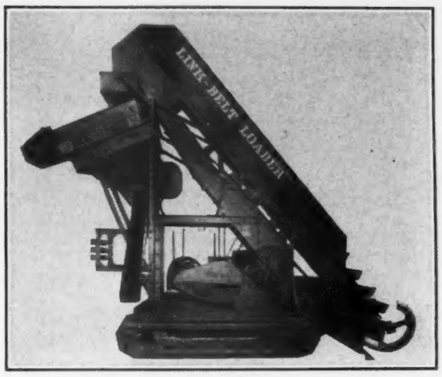
Loader with Vibrating Screen

THE Link-Belt Co., Philadelphia, Penn., announces the 1932 model Link-Belt vibrating screen loader for sand and gravel, crushed stone, etc.

Among the improvements that have been made is the use of a mechanically-vibrated screen of the Link-Belt positively-driven type, the amplitude of vibration, or throw of the screening surface, being set at the factory, before loader is shipped, to vibrate the material gently, yet intensively and positively, over the entire screening area.

The new screening arrangement provides 10 ft. clearance under the chute to truck.

With the positive-drive screen, the inclination of the screening surface can be varied on the job, between 18 and 25 deg. Cantilever leaf springs maintain the screen box at a constant angle. The screen bearings are of the self-aligning spherical roller-bearing type.



Loader uses vibrated screen

The entire loader is under the control of the operator on a large roomy platform. The bucket elevator capacity is 1¾ cu. yd. a minute, with uniform feed.

A three-speed transmission gives the crawlers a speed of 30 ft. a min., or 66 ft. per min., in the digging direction, and 27 ft. per min. in reverse. The driving machinery runs in oil and is enclosed in a housing.

Roll-Over Scrapers

THE LaPlant-Choate Manufacturing Co., Cedar Rapids, Ia., announces it has acquired the license to manufacture Automatic roll-over scrapers under the Renyolds patents. These scrapers, which are built in five sizes, might find application in some stripping operations.

Percussion Screen

THE ISBELL percussion screen has been used for years in the mining trade and is now offered to the gravel and crushed stone trade in an improved form by the Alloy Steel and Metals Co., Los Angeles, Calif.

Oscillating rocker arm gives vibration

The principle of vibration embodies an oscillating rocker arm so arranged as to deliver rapid shocks or percussions, alternately in opposite directions, to a tensioned screen and a resiliently suspended screen frame. The rapid percussions, together with the correlative action of the screen frame, produce almost instant stratification and cause the machine to operate at high efficiency, the manufacturer states.

The rocker arm proper is provided with a hammer head at each end which can be adjusted to strike a light or heavy blow, as required. It is oscillated by means of an unbalanced or weighted pulley, located directly over the center of it, every revolution of which causes the rocker arm to deliver four blows, or percussions, alternately in opposite directions, directly to both screen cloth and resiliently mounted frame in such a manner that every blow is said to produce a vibratory shock that is effective over the entire surface of the cloth.

According to the manufacturer, since the rocker arm is provided with a torsion shaft, the entire assembly requires no lubrication other than repacking of the weighted pulley with hard grease every six months to a year.

The hammer heads or rocker arms are free to rebound instantly when the blows are delivered. The power required to operate an Isbell percussion screen, regardless of size or load carried is less than ½ hp.

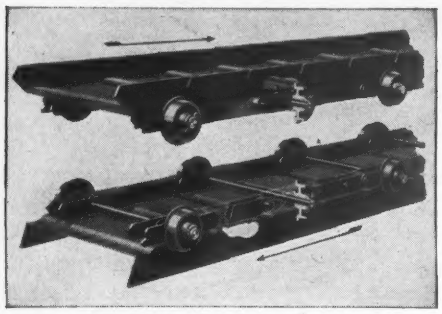
Fan Belt for High Speed Engines

THE B. F. Goodrich Co., Akron, Ohio, has developed a new high speed fan belt which has passed every test up to 5000 r.p.m., the manufacturer states.

To produce this belt it was necessary to design a new dynamometer set and an entire new line of machines, according to J. H. Connors, Goodrich vice-president, who made the announcement.

Steel Apron Conveyor

FOR long-time operation under exceptionally severe operating conditions is the claim made for the "Gravity Seal" steel apron conveyor announced by the Webster and Weller Manufacturing Co., Chicago, Ill. The "Gravity Seal" feature is based upon a new method of attaching the conveyor pans to the chains by means of a pattent pivot link. According to the manufacturer, the operation of this link, in connection with several minor constructional features, causes the pans to overlap so snugly as to eliminate the possibility of leakage of material and yet provide sufficient flexibility to enable the conveyor to travel evenly and without strain around the sprockets.



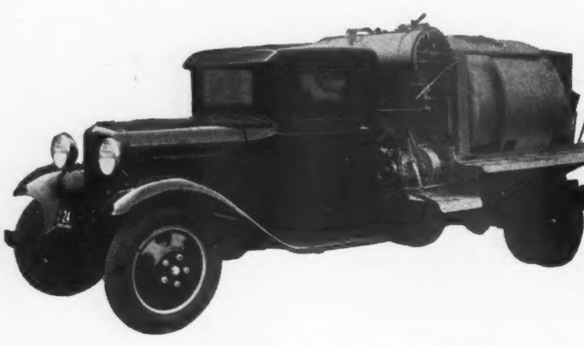
Pivot links more gravity seal

The cross rods are fitted with hardened bushings of unusual length. Roller parts may be replaced without unduly interfering with the operation of the conveyor, the manufacturer states. Rollers are idle only while the apron passes over sprockets. "Gravity Seal" construction is applicable to both apron conveyors and apron feeders.

Truck Mixer

A HIGHER SPEED truck mixer for the commercial concrete plant is offered in the 1932 Jaeger 1- and 1½-cu. yd. units mounted on the 1932 Ford chassis. The 1-yd. unit is furnished for 132-in. wheel base and is driven direct from the truck engine. The 1½-yd. unit is furnished with separate engine drive for 157-in. wheel base chassis.

With the greater speed of the new Ford, these truck mixer units are ideal for express service use by commercial concrete plants.



For express service by concrete plants

Gravel Spreader

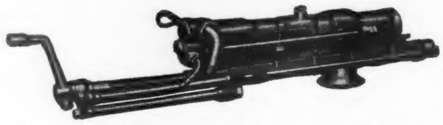
THE G. S. C. Hi-Speed spreader is a new device used for the distribution of crushed stone, gravel, sand and cinders, recently announced by the Efficient Road Machinery Co., Inc., Syracuse, N. Y. It can handle any size of stone up to No. 3 and spreads from a sprinkle to a heavy layer of several inches. The width of the spread is from 1 to 8 ft.

Spreads gravel from 1 to 8 ft. wide

This new device attaches to the rear of any standard truck without boring a single hole or using a special adapter. The driver can control its operation by means of a rope attached to the operating lever or it can be operated by a man at the rear of the truck.

Light Weight Drifting Drill

THE Gardner - Denver Co., Quincy, Ill., announces a new light weight, all purpose drifting drill, suitable for mines and quarries. Several improvements have been incorporated in it from the standpoint of drilling speed, efficiency, lack of vibration and reliability, the manufacturer states.



Backhead has dual air connections

The backhead has dual connections, allowing the air connection to be placed at either the side or the rear and allowing the water to be admitted on either the back or the side of the drill.

An integral lubricator supplies lubricant to all parts of the machine. A chamber surrounding the cylinder liner is used as a reservoir from which the lubricant is fed to the rear end of the chamber.

The front cylinder bushing has been eliminated and a bronze liner supporting the front end of the hammer is pressed into the cylinder. The bronze liner is renewable.

Specifications give the overall length of drill as 28 in. and weight mounted 142 lb.

Burning of Gaseous and Liquid Fuels

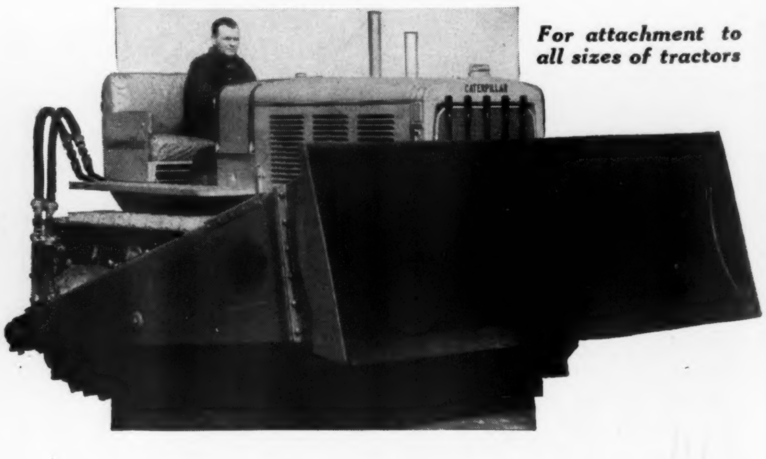
REPRINTS of three articles, "Tangential Firing of Gaseous and Liquid Fuels," "Corner Firing of Blast Furnace Gas," and "Combination Burning of Blast Furnace Gas and Pulverized Fuel," have been issued by the Combustion Engineering Corp., New York, N. Y.

In this series of articles the author discusses the recent developments in methods of firing and furnace design, which are being successfully applied for burning gaseous and liquid fuels, either singly or in combination with pulverized fuel. Several installations are described and data are given on operation.

Hydraulic Bulldozer

A NEW type of bulldozer is announced by the Blaw-Knox Co., of Pittsburgh, Penn.

The Blaw-Knox (Ateco) hydraulic bulldozer is made for attachment to all sizes of tractors. Unusual design features are that the power is hidden in the operating mechanism, fully protected from dust and dirt; the Bulldozer bowl is curved, designed to lift and roll dirt; the cutting edge is made of alloy steel; the bowl is electrically welded, heavily reinforced, supported by two side arms and attached to the tractor truck frame; and its compact box type of construction allows the blades to work within close limits of the tractor.



For attachment to all sizes of tractors

Hold Three More Successful Meetings of Safety Series

MEMBER cement mills of the Portland Cement Association recently held a series of three regional safety meetings, all reported as among the best yet held under the association's auspices.

The meeting held at the Raleigh hotel, Washington, D. C., on April 7 was attended by delegates from seven plants in the Chesapeake region, which include the Lehigh plants at Fordwick, Va., and Union Bridge, Md., the Medusa white and gray plants at York, Penn., the Lone Star plant at Norfolk, Va., and the North American cement plant at Hagerstown, Md., and lime plant at Martinsburg, W. Va. The meeting held at the Governor Clinton hotel, Albany, N. Y., on April 12 listed in its attendance key operating men of the Canada plants at Montreal and Hull, Quebec; Glens Falls plant at Glens Falls, N. Y.; Lawrence plant at Thomaston, Maine; Lone Star plant at Hudson, N. Y.; North American plants at Howes Cave and Catskill, N. Y.; Pennsylvania-Dixie plant at Portland Point, N. Y., and Universal Atlas plant at Hudson, N. Y.

Similarly good representation was reported at the third meeting of the eastern group at the Fort Pitt hotel, Pittsburgh, Penn., on April 15, at which the following mills participated: Canada mill at Port Colborne, Ont.; Great Lakes mill at Buffalo, N. Y.; Green Bag mill at Neville Island, Penn.; Lehigh mill at Newcastle, Penn.; Medusa mill at Wampum, Penn.; Pittsburgh Plate Glass mill at Zanesville, Ohio; Universal Atlas mill at Universal, Penn., and West Penn mill at West Winfield, Penn. The cement mills of the Lehigh Valley region are to hold their regional meeting at Easton, Penn., on Friday, June 3.

A. R. Couchman Presides at Washington

A. R. Couchman, safety director of the North American Cement Corp., acted as general chairman of the Washington meeting. The program was as follows: Morning session: "Safety Progress During the Past Year," by Stanley Owens, safety engineer, Portland Cement Association; "Eliminating Minor Accidents," by Paul A. Leichel, assistant superintendent, North American Cement Corp., Hagerstown, Md.; and "Suggested Procedure for Safety Meetings," by Howard Gray, power foreman, Lehigh Portland Cement Co., Union Bridge, Md. Afternoon session: "Emergency First Aid," paper and demonstration by Comm. W. E. Longfellow, American Red Cross; "The Safe Drivers League," by Mr. Owens; "Regional Safety Meetings and Trophy Dedications of 1931," by Wm. M. Powell, with motion pictures showing these occasions. Daniel Harrington, chief engineer, U. S. Bureau of Mines, spoke at the luncheon and Congressman W. R. Coyle of Pennsylvania was the dinner speaker.

C. H. Sonntag Holds Albany Gavel

C. H. Sonntag, plant manager of the Lawrence Portland Cement Co. at Thomaston, Maine, and widely known cement plant engineer, headed the program committee as general chairman of the Albany meeting. Morning session program: Report of progress of mills of the district during 1931 in safety work, by Stanley Owens; symposium, "Winning the Association Safety Trophy at Our Mill," by G. A. Witte, assistant general manager, North American; Clifford H. Boyden, repairman, Glens Falls; E. P. Werner, superintendent, Pennsylvania-Dixie, and O. E. Wishman, safety engineer, Lawrence. Afternoon session: "Objectives of the Safe Drivers League," by A. R. Couchman, North American; "Avoiding Electrical Accidents," by J. M. Pomeroy, chief electrician, North American; "Eliminating Minor Accidents," by Walter J. Brennan, safety engineer, state of Maine. The luncheon speaker was Hon. J. D. Hackett, director of the division of industrial hygiene, New York State Department of Labor. The dinner program consisted of entertainment supplied by talent selected from the various mill organizations.

Albany regional safety meeting of the Portland Cement Association, April 12, 1932

R. L. Slocum Pilots Pittsburgh Program

Arrangements for the Pittsburgh meeting were conducted by R. L. Slocum, superintendent of the Universal plant of the Universal Atlas Cement Co., who acted as general chairman. After a message of welcome from the Pittsburgh Chamber of Commerce, Stanley Owens directed the customary review of cement mill accidents during the past year. Robert W. McAllister, superintendent, Pittsburgh Plate Glass Co.'s cement plant at Fultonham, Ohio, analyzed his plant's successful fight against accidents. W. M. Powell, Medusa, traced the progress of minor accidents and warned against disregard of the smaller injuries as one of the most prolific causes of lost time. He also said that the slovenly practice which admits of continued small accidents will always keep the plant insecure against the big ones. The remainder of the morning session was occupied with discussion of safety problems.

The afternoon program included the following papers: "The Foundation of Safety" by Bert C. Wood, public relations counsel, Youngstown, Ohio; "Eye Injuries and Eye Protection" by J. B. Zook, chief engineer, Great Lakes Portland Cement Corp.; "Highway and Motoring Hazards" by L. W. McIntyre, traffic engineer, City of Pittsburgh; and "Dealing with Minor Accidents" by C. E. Ralston, safety engineer, Pittsburgh Plate Glass Co.

Other speakers at the meeting included L. H. Burnett, safety engineer of the Carnegie Steel Co. who spoke at luncheon, and H. S. Metcalf, director of public relations of the West Penn Electric Co., Pittsburgh, who spoke at the dinner.

Attendance at all three of these meetings was greater than at corresponding meetings last year, indicating continued keen interest in safety matters.

Producer Leases Property for Sand and Gravel Operation

A LEASE for a gravel and sand plant on the property of the city lying about a mile south of Harmony, Ind., has been granted by the Brazil city council to the Harmony Gravel Co., composed of George and John Butler and Bert G. Clark.

The city is leasing about 15 acres of land under which is said to be a large deposit of gravel. The city will receive royalty of 15c. per cu. yd.

The city of Brazil is now leasing gravel pits to two different concerns, the Brazil Sand and Gravel Co. having a plant on city grounds near the water works.—*Brazil* (Ind.) *Times.*

To Make Super Cement

THE KOSMOS Portland Cement Co., Louisville, Ky., has been licensed by the Super Cement Co. of Detroit, Mich., to produce Kosmos "Super" cement for sale in its territory. There are now 14 mills producing "Super" cement under license.

Outline of Program for Lime Association Meeting

THE PROGRAM for the annual meeting of the National Lime Association to be held in Cleveland, Ohio, May 24-25, will include a number of very interesting speakers of national reputation and their respective messages should stimulate lagging confidence and morale.

Other features of the two-day session will include discussions by men in the lime industry. The theme of these talks will be that of constructive marketing in developing the tremendous potential tonnage for lime in the construction field.

Immediately following the banquet there have been scheduled two short addresses by men prominent in their respective lines of endeavor—one, a discussion involving present-day nation-wide economic problems and the other less serious in text.

Guy W. Phelps

GUY W. PHELPS, general manager of the Flint Sandstone Brick Co., Flint, Mich., died on March 17 after a short illness.

Mr. Phelps had been associated with the sand-lime brick industry for over 15 years, three of which he served as secretary of the Sand-Lime Brick Association. He has attended meetings of the association regularly since joining in 1917. Mr. Phelps was born in Saginaw county, Mich., in 1884, moving to Flint about 1907.

Guy W. Phelps

P. J. Freeman Returns to Pittsburgh Testing Laboratory

THE PITTSBURGH Testing Laboratory announces that P. J. Freeman is now associated with it as consulting engineer. Mr. Freeman returns to this organization after serving for many years as chief engineer of the bureau of tests and specifications of Allegheny county, Penn. He will specialize upon problems relating to municipal construction, roads and pavements, technological control of concrete production and placement, and special investigations.

Southwestern Trophy Dedication

THE FIRST CELEBRATION of the season in connection with the winning of the Portland Cement Association safety trophy for 1931 will take place at the El Paso, Tex., plant of the Southwestern Portland Cement Co. on which occasion the plant's new trophy, erected on a fine setting at the plant will be unveiled. Among the officials in El Paso for the ceremony will be Frank H. Powell, president; Calvin C. Merrill, vice-president, and Max Koffman, secretary, of the Southwestern company, and T. B. Warden, district engineer of the Portland Cement Association.

Erects Crushed Stone Plant in California

A NEW rock crushing plant is being erected near Whitewater, Calif. The Palm Springs Builders Supply Co., in which Earl B. Gilmore, president of the Gilmore Oil Co., and A. F. Hicks of Palm Springs are stockholders, is installing the crusher.—*Los Angeles* (Calif.) *Times.*

Plans Rock Asphalt Plant in Missouri

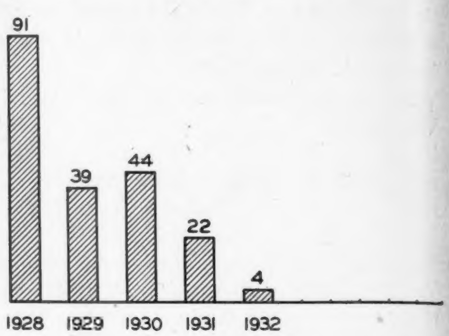
THE Nevada, Mo., plant of the Mo-Ve-Co Asphalt Co. will be opened soon, John A. Pratt, a member of the company, announces. Two shovels are stripping and mining rock asphalt on the Stover farm west of Nevada, Mr. Pratt said, and they plan to start shipping to St. Louis immediately.

If a market for the rock asphalt can be found the company plans to open a mill west of Nevada. The plans and specifications for this mill have been drawn and call for the expenditure of $60,000. The plans provide for a mill with a capacity of 500 tons a day. Hubert Howard of the Binkley Coal Co., Chicago, Ill., is interested in the erection of the mill. The present Nevada plant has a capacity of 100 tons a day.

With Mr. Pratt in Nevada are Bert R. Schull, a road contractor of Huron, S. D.; E. J. McDonald of Hopkins, Minn., and Arnold H. Franks of Minneapolis, Minn.

March Accidents in Cement Industry

MARCH was another low record month for accidents in the member plants of the Portland Cement Association. Low rate of operation, as well as low rate of mishaps for the number of man-hours worked, account for the showing.



March accidents in cement industry

None of the four personal injury accidents involving loss of time caused a permanent disability of any sort and severity considered, the March record was better than that of February, when the frequency was the same for the past month. Brief description of the four March accidents follows:

1. *Quarry.* Employe dumping truck lost control of crank, which spun out of his hands and hit him over right eye. Deeply lacerated wound and contusions resulted, causing loss of 12 days' time.

2. *Quarry.* Brakeman riding front of locomotive slipped off step due to snow. Both knees were injured in contact with locomotive. Lost time undetermined as yet.

3. *Raw Mill.* Repairman rolling trunnion through doorway allowed his finger to become jammed between trunnion and doorway. Injury consisted of fracture to third finger with loss of time undetermined as yet.

4. *Oiler* attempted to stop a cement leak between tube mill trunnion and feed tube by forcing stuffing gland with an iron bar. The latter became caught and pressed his hand against the gear guard. He withdrew his hand so rapidly that both palm and back were cut severely leaving tendons exposed. Loss of time undetermined as yet.

Foreign Trade Opportunities in Rock Products

OPPORTUNITIES for foreign trade in rock products as recently reported by the Bureau of Foreign and Domestic Commerce include: Cement, Natal, Brazil; cement, Campina, Brazil; cement, Quito, Ecuador; cement, Winnipeg, Canada; bleaching earth, Hamburg, Germany; beryl, lepidolite, amblydonite and fuller's earth, Grenoble, France; cement, Rosario and Buenos Aires, Argentina.

Recognized the World Over as the Leader in Its Field

Rock Products

With which is Incorporated CEMENT and ENGINEERING NEWS Founded 1896

Entered as second-class matter, July 2, 1907, at the Chicago, Ill., postoffice under the Act of March 3, 1879.

Contents for May 21, 1932

Departments

(Rock Products is indexed in the "Industrial Arts Index," which can be found in any Public Library)

TRADEPRESS PUBLISHING CORPORATION

542 South Dearborn Street, Chicago, Illinois, U. S. A.

Nathan C. Rockwood, President; Fred S. Peters, Vice-President
T. I. McKnight, Secretary I. H. Callender, Treasurer

NATHAN C. ROCKWOOD, *Editor and Manager*
EDMUND SHAW, Los Angeles, Calif., *Contributing Editor*
EARL C. HARSH, WALTER B. LENHART, H. O. HAYES, *Associate Editors*

A. M. STERN, *Assistant Editor*
FRED S. PETERS, *Advertising Manager*
JOS. J. KOLAR, *Production Manager*

E. H. PAULL, *Eastern Representative*
250 Fifth Ave., New York City. Tel. Ashland 4-4723

GEORGE M. EARNSHAW, *Central Advertising Manager*
12940 Clifton Blvd., Lakewood, Ohio. Tel. Boulevard 4353

CARL L. WALKER, *Western Representative*
Chicago. Tel. Wabash 3714-3715

SUBSCRIPTION—Two dollars a year to United States and Possessions. $4.25 a year to Canada (including duty) and $4.00 to foreign countries. Twenty-five cents for single copies

TO SUBSCRIBERS—Date on wrapper indicates issue with which your subscription expires. In writing, to have address changed, give old as well as new address

The A. B. P. is a nonprofit organization whose members have pledged themselves to a working code of a practice in which the interests of the men of American industry, trade and professions are placed first—a code demanding unbiased editorial pages, classified and verified paid subscribers, and honest advertising of dependable products. The A.B.C. is an organization which audits and verifies publishers' circulation claims and records.